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VOL. 19 FEBRUARY, 1926 No. 1

Proceedings of the Thirty-eighth Annual Meeting of the American Association of Economic Entomologists

The thirty-eighth annual meeting of the American Association of Economic Entomologists was held in the Kansas City School of Law, Kansas City, Missouri, December 29, 1925 to January 1, 1926.

The Section of Plant Quarantine and Inspection convened at 10:15 a. m., Tuesday, December 29th, and continued through the day. In the absence of Chairman C. H. Hadley, E. N. Cory of College Park, Maryland, was elected Chairman pro tem. Some very interesting papers were presented, covering the recent work of the Federal Horticultural Board and Federal and State plant quarantine regulations were discussed at length.

The Extension Entomologists held a meeting Tuesday evening, December 29, at the Hotel Baltimore, which was well attended.

The Section of Apiculture held an interesting meeting during Wednesday forenoon, December 30. About 10 interesting papers were presented and discussed, together with a symposium on "Spraying and Dusting of Fruit Trees and their effects upon the Honey Bee."

Various conferences were held throughout the meeting period of the general Association on such matters as Hessian Fly, European Corn Borer, etc.

The Crop Protection Institute also had an informal meeting to discuss matters pertaining to that work.

This Association held a joint session with the Entomological Society of America on Wednesday afternoon at the Hotel Baltimore for the purpose of holding a symposium on "Insect Parasitism." About 200 members of the two societies, together with visitors, were present. Seven papers covering the general subject of insect parasitism were delivered. Considerable interest was evinced in the papers on this subject owing to their practical phase in the control of insects in general.

The opening meeting of the general Association was called to order

at 10 a. m., Thursday, December 31, by First Vice-President R. N. Chapman. President H. A. Gossard died December 18 and First Vice-President Chapman immediately assumed the duties of that office. The annual reports were read and the business of the opening session was transacted. President H. A. Gossard prepared an address which was read by Acting President R. N. Chapman at the beginning of the afternoon session. The sessions were continued through Thursday and closed with the final business session late Friday afternoon.

The Entomologists Dinner was held Friday evening at the Hotel Baltimore and was well attended—the local entomologists of Kansas State Agricultural College and the University of Kansas having provided a unique and interesting entertainment consisting of cartoons and parodies on the leading entomologists.

The general program contained many interesting and important papers, grouped according to subject-matter, as: "Insects Affecting Fruit," "Insects Affecting Stored Products," "Insecticides," "Insects Affecting Forest and Shade Trees," "Insects Affecting Cereal, Forage and Field Crops," "Insects Affecting Truck Crops," "Insects Affecting Man and Animals," and "Insects Affecting Greenhouse Crops." The calibre of the papers generally was quite high but among these may be mentioned three striking papers which were considered by several members of the Association as outstanding contributions to entomology and science in general. These are "The Efficacy of Lead Arsenate in Protecting Apples against Codling Moth Injury" by R. H. Smith, Stanford University, Calif.; "The Influence of Temperature upon the Amount of Food Consumed and the Number of Eggs Laid by Grasshoppers" by J. R. Parker, Bozeman, Mont., and "An Insect 'Olfactometer'" by N. E. McIndoo, Washington, D. C.

The business proceedings form Part I of this report and the addresses, papers and discussions form Part II.

The Proceedings of the Sections of Plant Quarantine and Inspection and Apiculture will also be included in Part II.

PART I. BUSINESS PROCEEDINGS

The meeting was called to order by Acting President R. N. Chapman at 10 a. m., Thursday, December 31, 1925. About 200 members and visitors attended the sessions. The following members were present:

Ackerman, A. J., Washington, D. C.
Arnold, George F., Agricultural College, Miss.
Baerg, W. J., Fayetteville, Ark.
Balduf, W. V., Urbana, Ill.
Ball, E. D., Sanford, Fla.

Becker, G. G., Little Rock, Ark.
Bentley, G. M., Knoxville, Tenn.
Bigger, J. H., Jacksonville, Ill.
Bilsing, S. W., College Station, Texas.
Bishopp, F. C., Dallas, Texas.
Borodin, D. N., New York, N. Y.
Breakey, Edward P., Lawrence, Kan.
Bryson, Harry R., Manhattan, Kan.
Butcher, Fred D., Ames, Iowa.
Caesar, Lawson, Guelph, Canada.
Cartwright, W. B., Centralia, Ill.
Cecil, Rodney, Birmingham, Ala.
Chamberlin, T.R., Salt Lake City, Utah.
Chapman, R. N., Minneapolis, Minn.
Childs, Leroy, Hood River, Oregon.
Coleman, G. A., Berkeley, Calif.
Collins, C. W., Melrose Highlands, Mass.
Corkins, C. L., Laramie, Wyo.
Cory, E. N., College Park, Md.
Crawford, H. G., Ottawa, Canada.
Davis, J. J., Lafayette, Ind.
Dean, G. A., Manhattan, Kan.
Dean, M. L., Boise, Idaho.
DeLong, D. M., Columbus, Ohio.
Doucette, C. F., Willow Grove, Pa.
Drake, C. J., Ames, Iowa.
Eddy, C. O., Clemson College, S. C.
Eddy, M. W., Carlisle, Pa.
Fackler, H. L., Knoxville, Tenn.
Faxon, Richard, Columbus, Ohio.
Fitch, H. W., Ithaca, N. Y.
Fletcher, R. K., College Station, Texas.
Flint, W. P., Urbana, Ill.
Ford, A. L., Brookings, S. D.
Fracker, S. B., Madison, Wis.
Frison, T. H., Urbana, Ill.
Fulton, B. B., Ames, Iowa.
Gaines, R. C., Tallulah, La.
Gates, L. M., Manhattan, Kan.
Gibson, Arthur, Ottawa, Canada.
Glasgow, R. D., Urbana, Ill.
Glenn, P. A., Urbana, Ill.
Granovsky, A. A., Madison, Wis.
Grube, W. M., Kansas City, Mo.
Gui, H. G., Manhattan, Kan.
Guyton, L. E., Auburn, Ala.
Guyton, T. L., Harrisburg, Pa.
Harned, R. W., Agricultural College, Miss.
Harris, J. A., Raleigh, N. C.
Haseman, Leonard, Columbia, Mo.
Hawley, I. M., Logan, Utah.
Hayes, W. P., Urbana, Ill.
Herms, W. B., Berkeley, Calif.
Hill, A. C., St. Louis, Mo.
Hinds, W. E., Baton Rouge, La.
Horsfall, J. L., New York City.
Houser, J. S., Wooster, Ohio.
Howard, L. O., Washington, D. C.
Huber, L. L., Wooster, Ohio.
Hungerford, H. B., Lawrence, Kan.
Hunter, S. J., Lawrence, Kan.
Hyslop, J. A., Washington, D. C.
Isely, Dwight, Fayetteville, Ark.
Jones, C. R., Fort Collins, Colo.
Jones, E. T., Columbia, Mo.
Jones, M. P., Columbus, Ohio.
Johnston, H. B., Khartoum, Sudan.
Kelly, E. G., Manhattan, Kan.
Kelshiemer, E. G., Ames, Iowa.
Kimball, H. H., Agricultural College, Miss.
Knight, H. H., Ames, Iowa.
Lange, Richard C., Webster Groves, Mo.
Langford, G. S., Fort Collins, Colo.
Leiby, R. W., Raleigh, N. C.
List, G. M., Fort Collins, Colo.
Marcovitch, S., Knoxville, Tenn.
Marlatt, C. L., Washington, D. C.
McColloch, J. W., Manhattan, Kan.
McDaniel, Eugenia, East Lansing, Mich.
McIndoo, N. E., Washington, D. C.
Metcalf, C. L., Urbana, Ill.
Mickel, C. E., St. Paul, Minn.
Milum, V. G., Madison, Wis.
Moore, William, New York, N. Y.
Morrill, A. W., Los Angeles, Calif.
Mortensen, E., Uvalde, Texas.
Ness, Henry, Ames, Iowa.
Newton, J. H., Paonia, Colo.
Nickels, C. B., Clemson College, S. C.
O'Kane, W. C., Durham, N. H.
Osborn, Herbert, Columbus, Ohio.
Osburn, Raymond C., Columbus, Ohio.
Paddock, F. B., Ames, Iowa.
Painter, H. R., West Lafayette, Ind.
Parker, J. R., Bozeman, Mont.

Parker, R. R., Hamilton, Mont.
Pellett, F. C., Hamilton, Ill.
Poos, F. W., Sandusky, Ohio.
Porter, B. A., Washington, D. C.
Readio, Philip A., Lawrence, Kan.
Reeves, George I., Salt Lake City, Utah.
Reeves, J. A., Columbus, Ohio.
Regan, W. S., Bozeman, Mont.
Ressler, I. L., Albia, Iowa.
Riley, W. A., St. Paul, Minn.
Roberts, Raymond, Lincoln, Neb.
Robinson, J. M., Auburn, Ala.
Robinson, William, St. Paul, Minn.
Rosewall, O. W., Baton Rouge, La.
Rude, C. S., College Station, Texas.
Ruggles, A. G., St. Paul, Minn.
Safro, V. I., Los Angeles, Calif.
Sanders, J. G., Philadelphia, Pa.
Sanders, P. D., College Park, Md.
Sasscer, E. R., Washington, D. C.
Satterthwait, A. F., Kirkwood, Mo.
Schenk, Gilbert, Fort Collins, Colo.
Schoene, W. J., Blacksburg, Va.
Schweiss, G. G., Reno, Nevada.
Severin, H. C., Brookings, S. D.
Shelford, V. E., Champaign, Ill.
Simanton, F. L., Benton Harbor, Mich.
Smith, R. C., Manhattan, Kan.
Smith, R. H., Berkeley, Calif.
Stafford, E. W., Agricultural College, Miss.
Strong, Lee A., Sacramento, Calif.
Sullivan, K. C., Columbia, Mo.
Swaine, J. M., Ottawa, Canada.
Swenk, M. H., Lincoln, Neb.
Van Dyke, E. C., Berkeley, Calif.
Wade, Otis, Columbia, Mo.
Wadley, F. M., Wichita, Kan.
Wall, R. C., St. Paul, Minn.
Webster, R. L., Fargo, N. D.
Wellhouse, Walter, Ames, Iowa.
Whelan, Don B., Lincoln, Neb.
Whitmarsh, R. D., Wooster, Ohio.
Wood, W. B., Washington, D. C.
Woodruff, L. C., Lawrence, Kan.
Worthley, L. H., Arlington, Mass.

ACTING PRESIDENT R. N. CHAPMAN: The Association will please come to order. Because of the death of our President and by virtue of my office as First Vice-President of this Association, it becomes my duty to assume the duties of the President. The first business is the report of the Secretary.

REPORT OF THE SECRETARY

The membership of the Association at the time of the Washington meeting together with the election of new members, resignations, those dropped for nonpayment of dues and losses by death since, is summarized as follows:

	Active	*Associate*	*Foreign*
Total membership, beginning of Washington meeting	348	353	48
Transferred from Associate to Active, Washington meeting	+ 35	— 35	
	383	318	48
(No re-instatements, Washington meeting)			
Members elected, Washington meeting		+ 98	+ 1
	383	416	49 + 1*
Resignations accepted, Washington meeting	— 1	— 8	

*Professor Karl Sajo, Godollo-Veresegyhaz, Hungary, erroneously reported dead at Washington meeting, is hereby restored to the list.

Total membership at close of Washington meeting	382	408	50
Dropped for non-payment of dues, 1925	— 3	— 18	
Deaths recorded since last meeting	— 5	— 4	
Total membership, beginning of Kansas City meeting	374	386	50
GRAND TOTAL	810		
Net gain during 1925	61		

At the time of preparing this report, news was received that President H. A. Gossard died at his home in Wooster, Ohio, December 18, 1925. This was a great shock to the officers and membership of the Association. President Gossard had been a member for a long term of years and was an entomologist of unusual ability, having carried on and directed the entomological investigations at Wooster, Ohio, in a manner that had won for him an enviable reputation as an entomologist. He was deeply interested in Association matters and hard work in connection with Association and Station duties was responsible for his nervous breakdown and subsequent death at middle age.

Dr. W. D. Hunter, an active member and past president of this Association, died suddenly of apoplexy Oct. 13, 1925, at the age of 50. Since 1905 Dr. Hunter had been in charge of Southern Field Crop Insect Investigations, U. S. Bureau of Entomology. He was an eminent entomologist, having achieved remarkable results in his chosen profession during his short life. Probably his most outstanding work was the progress made under his direction in the eradication of the pink boll worm from Louisiana and Texas.

Mr. F. H. Mosher, Assistant Entomologist, U. S. Bureau of Entomology, Gipsy Moth and Brown-tail Moth Investigations, Melrose Highlands, Mass., died of penumonia April 18, 1925 at the age of 64. He was an active member of this Association and had been identified with Gipsy Moth and Brown-tail Moth work since 1893. Starting in 1905 and continuously to the time of his death he was stationed at the Gipsy Moth Laboratory, having conducted and published the results of some interesting lines of investigation.

C. W. Minott, Assistant Entomologist, U. S. Bureau of Entomology, Gipsy Moth and Brown-tail Moth Investigations, Melrose Highlands, Mass., died Nov. 28, 1925 from apoplexy at the age of 66. He was an active member and connected with the suppression work against the Gipsy Moth in Massachusetts since 1893 until his employment by the Bureau of Entomology in 1911. From 1911 to the time of his death, he was engaged in field experiments to do with the food habits, increase and decrease of the Gipsy Moth.

H. P. Wood, an active member, died at Hyde Park, Mass., in April 1925. At the time of becoming a member he was located at Dallas, Texas. Details of his life work and death are lacking for this report.

R. P. Barnhart, an associate member, and inspector of the Mississippi State Plant Board and located at Ocean Springs, died July 21, 1925. He was 50 years of age and was at one time with the Bureau of Plant Industry on Citrus Canker.

Albert Koebele, an associate member, died at Waldkirch, Germany, Dec. 28, 1924, at the age of 72. He joined the entomological force of the U. S. Department of

Agriculture in 1882. On a trip to Australia in 1889 he discovered and sent to California living specimens of *Vedalia* (*Novius*) *cardinalis* which were established there and which proved to be the first successful experiment of its kind in this country. He was later located in Hawaii and returned to his old home in Germany about 1912 or 1913.

John D. More, an associate member, met his death some time during 1924 when the residence in which he was living in Atlanta, Ga., was burned.

P. R. Myers, an associate member, died Feb. 12, 1925 at Carlisle, Pa. He was employed by the U. S. Bureau of Entomology, Division of Cereal and Forage Crop Insects, and had just completed a very important manuscript dealing with the entire group of parasites affecting the Hessian fly.

The annual meeting of the Pacific Slope Branch was held at Reed College, Portland, Oregon, June 18–20, 1925. The meeting was well attended and the proceedings published in the October JOURNAL.

JOURNAL OF ECONOMIC ENTOMOLOGY

The volume of the JOURNAL for 1923 consisted of 568 pages; for 1924, 693 pages, and for 1925, 872 pages—an increase of 179 pages over that of the previous year. The size of the volume has increased steadily for the past few years without increasing the cost of subscription—the extra costs of printing having been met by increased numbers of subscriptions and sale of back numbers. A substantial balance is still in the treasury and it may be possible to still further increase the size of the volume in spite of the fact that members and subscribers are already getting considerable for the net cost to them. Full sets of Volume 1 are exhausted, No. 2 of that volume being out of print—the rest of the numbers sell for $1.00 each. Vol. 8 and Vol. 11 are selling for $4.00 each; Vol. 12 for $5.00 and all remaining volumes for $3.50 each. On foreign orders 50c additional is charged for postage.

From 1922 to 1924 inclusive the writer served as Circulation Agent for the JOURNAL but during the present year has combined the work with that of Business Manager. Many of the members are still interested in getting new subscriptions and have done very well indeed in interesting new subscribers and by inducing new members to join the Association which means added subscriptions.

The following table shows the total domestic and foreign subscribers in 1913, 1922, 1924 and 1925:

	1913	*1922*	*1924*	*1925*		*1913*	*1922*	*1924*	*1925*
Alabama	3	12	9	9	Iowa	5	12	16	16
Arizona	7	6	8	10	Kansas	16	17	18	22
Arkansas	2	6	5	5	Kentucky	4	6	4	4
California	34	63	78	95	Louisiana	12	13	18	17
Colorado	7	14	14	15	Maine	5	5	8	9
Connecticut	10	20	16	16	Maryland	11	10	14	12
Delaware	3	3	4	5	Massachusetts	48	83	74	75
Dist. of Col.	50	53	55	56	Michigan	15	12	13	14
Florida	7	20	18	22	Minnesota	10	14	14	16
Georgia	6	9	10	12	Mississippi	4	25	20	29
Idaho	2	4	6	5	Missouri	8	13	15	15
Illinois	30	28	29	33	Montana	5	9	12	11
Indiana	16	13	13	14	Nebraska	3	2	3	5

	1913	1922	1924	1925		1913	1922	1924	1925
Nevada	1	2	2	2	South Carolina	4	1	6	14
New Hampshire	4	7	6	10	South Dakota	1	2	2	2
New Jersey	14	23	27	30	Tennessee	6	11	14	13
New Mexico	3	3	2	2	Texas	16	25	23	26
New York	52	61	76	84	Utah	8	13	9	11
North Carolina	6	9	10	11	Vermont	1	1	2	2
North Dakota	0	1	2	2	Virginia	7	15	18	19
Ohio	22	33	48	47	Washington	8	12	9	13
Oklahoma	2	4	5	5	West Virginia	5	5	6	7
Oregon	10	11	11	12	Wisconsin	6	15	14	17
Pennsylvania	18	39	44	48	Wyoming	0	1	2	2
Rhode Island	3	2	4	5					
Total for U. S.						520	768	837	926

	1913	1922	1924	1925		1913	1922	1924	1925
U. S. Possessions	26				P. R. & Cuba		6	6	10
Hawaii		11	10	10	Canada	27	43	47	42
Panama & Virgin Islands		2	2	3	Foreign	132	163	219	245
Philippines		5	3	3	GRAND TOTAL	705	998	1124	1239

It will be noted from the above table that a gain of 115 subscriptions was made during 1925—showing a proportionate gain from the United States and from foreign countries.

INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY, I AND II

Orders for these two volumes have come in slowly but rather regularly during the year. An advertisement has been run in the JOURNAL and since the publication of Index III several orders have come in for full sets. In June Index I and II accounts were combined at which time Index II, after allowing for the payment of $75.00 which had been borrowed from the Association, had squared its indebtedness—thus requiring five years before any profit could be realized. From this combined account $675.00 was loaned towards the publication of Index III.

INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY, III

This Index was completed and mailed about August 15, 1925. It contains 441 pages, being somewhat larger than Index II. 1000 copies were printed, all of which were bound. The Secretary was authorized to borrow sufficient funds from Index I and II, Journal and Association, for the publication of the 3rd volume. A total of $1675.00 was needed during the year above what was received from advance cash sales to pay the bills. The financial statement shows the details of this fund.

Some advertising has been done to bring this to the attention of college and city libraries with somewhat favorable results. Our advertisement is run in each issue of the JOURNAL.

PERMANENT FUND

In accordance with instructions from the Executive Committee, $600.00 was transferred from the Association Fund to the Permanent Fund. The interest on Liberty bonds and on saving bank deposits has been credited to this fund as shown in the

financial statement. Three applications for life membership, each accompanied with fee of $100.00, were received up to December 7 and also credited to this account.

ASSOCIATION STATEMENT

Balance in Treasury, November 29, 1924		$ 987.02
Amount received from dues and separates		1136.76
Amount received from bank interest		25.00
Amount received from loan to Index III		279.00
Amount received from loan to Index II		75.00
Paid—Stenographic Report, 1924	$ 177.48	
Postage	131.50	
Programs and Notices	69.52	
Supplies and Stationery	55.53	
Telegraph and Express	15.46	
Returned Checks and Collection Charges	8.00	
Expenses of Pacific Slope Branch	14.65	
Funds Transferred to Index III	379.00	
Funds Transferred to Permanent Fund	600.00	
Secretary	100.00	
Clerical Work, Secretary's Office	51.50	
Miscellaneous Expenses, Secretary's Office	12.50	
	$1615.14	
Balance, December 7, 1925	887.64	
	$2502.78	$2502.78

Balance, Deposited in First National Bank, Malden, Mass.

JOURNAL STATEMENT

Balance in Treasury, November 29, 1924		$2687.39
Amount received from Subscriptions, Advertising, etc.		4573.59
Amount received from bank interest		40.00
Paid—Postage	$ 258.92	
Printing	3298.42	
Programs and Notices	6.75	
Supplies and Stationery	28.96	
Half-tones and engravings	214.47	
Telephone, Express and carfares	1.10	
Returned Checks	19.50	
Editor	200.00	
Clerical Work, Editor's Office	95.00	
Secretary	100.00	
Clerical Work, Secretary's Office	51.50	
Miscellaneous Expenses, Secretary's Office	8.11	
Loan to Index III	900.00	
	$5182.73	
Balance, December 7, 1925	2118.25	
	$7300.98	$7300.98

Balance, Deposited in First National Bank, Malden, Mass...	$1614.91	
Balance, Deposited in Melrose Trust Company, Melrose, Mass.	503.34	
	$2118.25	

INDEX I AND II

Balance in Treasury, November 29, 1924.....	$543.73 13.64	
		$ 557.37
Received from Sales.....		223.80
Interest on Deposits {.....		15.00
{.....		29.00
Postage.....	8.40	
Loans from Association.....	75.00	
Transferred Funds to Index III.....	675.00	
Miscellaneous Expenses, Secretary's Office.....	6.71	
	$ 765.11	
Balance, December 7, 1925.....	60.06	
	$ 825.17	$ 825.17

Balance, Deposited in First National Bank, Malden, Mass.

INDEX III

Amount received as Loans:		
From Index I and II.....		$ 675.00
From Journal.....		900.00
From Association.....		379.00
Interest on Deposits.....		4.17
Amount received from sales.....		883.66
Paid—Postage.....	$ 26.46	
Printing.....	2194.46	
Notices.....	13.23	
Supplies and Stationery.....	.77	
Returned Checks.....	5.00	
Editor.....	200.00	
Proof-reading, Editor's Office.....	75.00	
Freight and Miscellaneous Expenses.....	12.80	
Paid to Association on Loan.....	279.00	
	$2806.72	
Balance, December 7, 1925.....	35.11	
	$2841.83	$2841.83

Balance, Deposited in First National Bank, Malden, Mass.

Index III owes Index I and II.....	$ 675.00
Index III owes JOURNAL.....	900.00
Index III owes Association.....	100.00
Total indebtedness.....	$1675.00

PERMANENT FUND

Deposit, Melrose Savings Bank, November 29, 1924	$ 773.08
Interest on Deposits	35.18
Interest on Liberty Bonds	80.75
Paid into Permanent Fund from Association	600.00
Life Membership Fees, 1925	300.00
Balance, Melrose Savings Bank, December 7, 1925	$1789.01
Deposited, Melrose Savings Bank, Melrose, Mass., December 7, 1925	$1789.01
4¼% Liberty Bonds	1600.00
GRAND TOTAL	$3389.01

SUMMARY

Balance in Indices I and II Account, December 7, 1925	$ 60.06
Balance in Index III Account, December 7, 1925	35.11
Balance in JOURNAL Account, December 7, 1925	2118.25
Balance in Association Account, December 7, 1925	887.64
GRAND TOTAL	$3101.06

Respectfully submitted,
C. W. COLLINS, *Secretary*

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the report of the Executive Committee. I take it you all understand the circumstances under which this report had to be prepared.

REPORT OF THE EXECUTIVE COMMITTEE

One of the first official acts of your newly elected President was the dispatching of a circular letter to the membership of the Association soliciting co-operation and suggestions in the administration of the society's affairs.

In response to an invitation from Mr. K. Jordan of the Zoological Museum, Tring, Herts., England, Chairman of the Executive Committee of the Third International Congress on Entomology to be held at Zurich, Switzerland June 19–26, 1925, the President of your Association appointed Dr. L. O. Howard as chairman of the Delegates of the American Association of Economic Entomologists to represent our Association.

Your President, having learned that Mr. Arthur Gibson expected to attend the second conference of Imperial Entomologists to be held at London, England, June 9, 1925, wrote Mr. Gibson requesting him to convey greetings from the American Association of Economic Entomologists.

Vice-President Chapman was designated by the President to serve as official representative of the Association to attend the meeting of the Pacific Slope Branch held at Portland, Oregon, June 18–20. A letter from President Gossard was read and this has since been published in the JOURNAL. A special committee of the

Pacific Slope Branch has submitted a report covering the President's suggestions. This report will be referred to an appropriate committee.

Mr. Lee A. Strong of the Federal Horticultural Board was designated by the President to represent the American Association of Economic Entomologists at the annual meeting of the Cotton States Entomologists held at Atlanta, Georgia, February 3 to 5, 1925.

At the request of the Secretary, the President canvassed the members of the Executive Committee and received their unanimous consent to transfer funds of the Association to its permanent fund.

At the last meeting of the Association, the matter of raising the necessary $5,000 to supplement the $20,000 furnished by the Rockefeller Foundation for the carrying of the abstract preparation through the year 1925 was referred to the Executive Committee with power to act.

At the request of the President, the First Vice-President took charge of the matter and the Secretary was authorized to canvass the membership for contributions.

At the last annual meeting, a recommendation of the Executive Committee that the Secretary be bonded was favorably received. In compliance therewith, on November 9, 1925, a bond for $5,000 was executed by the President.

Dr. W. D. Hunter at the time of his death represented our Association as Scientific Trustee, Tropical Research Foundation. In response to a suggestion by Secretary Collins, your President directed that a letter be sent Dr. D. L. Van Dine, Central Baragua, Baragua, Camaguey Province, Cuba, on November 14, 1925, asking that he serve the remainder of Dr. Hunter's term. No reply has as yet been received from Dr. Van Dine.

Your President received a communication from the President of the American Society of Agronomy stating that at its last annual meeting that society had authorized the appointment of a joint advisory committee on research work on the control of the corn borer. A committee of ten was suggested, five from the American Association of Economic Entomologists and five from the American Society of Agronomy.

The Executive Committee recommends that a committee of five be appointed by the incoming president and that the secretary be instructed to inform the President of the American Society of Agronomy of the action.

The Third Pan-Pacific Science Congress will be held at Tokyo, Japan, October 27 to November 9, 1926, under the auspices of the National Research Council of Japan. The chairman of the Committee on Pacific Investigations of the American National Research Council has forwarded to our Association an invitation that a representative be appointed to attend the Congress and participate in the program. Your committee recommends that such a representative be appointed by the incoming president.

Endowment Fund

In compliance with a recommendation made by Mr. Burgess in his presidential address last year that active steps be taken to secure an endowment adequate to provide for the expanding needs of our Association, particularly those of administration and publication, the President named a preliminary committee consisting of Messrs. Burgess, Collins and himself to consider ways and means.

A circular letter was mailed to all active and associate members soliciting life memberships of $100 each, and containing suggestions as to the raising of the endowment fund.

The Cotton States Entomologists through a committee consisting of W. E. Hinds, R. W. Harned and G. M. Bentley made formal application to become a branch of the American Association of Economic Entomologists. This was approved by the Committee on Policy and also unanimously approved by the Executive Committee and is now recommended for the approval of the Association.

As a part of its routine duty, the Executive Committee has audited the books of the secretary and has found them correct in all details.

Respectfully submitted,

R. N. CHAPMAN
LEROY CHILDS
R. L. WEBSTER
C. W. COLLINS
Committee

APPLICATION OF THE ASSOCIATION OF COTTON STATES ENTOMOLOGISTS TO BECOME A BRANCH OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

TO THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS:

At the annual meeting of the Association of Cotton States Entomologists held at Birmingham, Alabama, January 10 and 11, 1924, it was voted to apply for recognition as a branch of the American Association of Economic Entomologists. As this matter was not presented to the latter Association in time for action at its annual meeting in Washington, D. C., the Cotton States Entomologists again considered the matter at the annual meeting held at Atlanta, Georgia, February 3 and 4, 1925, and it was again voted to apply for membership.

We request that this Organization be known as the Cotton States Branch of the American Association of Economic Entomologists, and that the territory embraced include the States of North Carolina, Tennessee, Arkansas, Oklahoma and Texas and all states south thereof.

It is understood that the JOURNAL OF ECONOMIC ENTOMOLOGY, the official organ of the Association, shall publish each year a notice concerning the meeting and a resume of the business transactions which will be furnished by the officers of the branch. Inasmuch as publication facilities in the JOURNAL are somewhat limited, it is agreed and understood that admission as a branch does not imply the publication in the JOURNAL of the entire proceedings at annual or other meetings, and furthermore it is understood that officers of the branch, shall, if it becomes necessary to restrict the space allowed for publication of papers, decide, in cooperation with the editorial board, which papers shall be published.

The Association of Cotton States Entomologists was organized in Atlanta, Georgia, December 1908, with W. E. Hinds as President and A. F. Conradi as Secretary. It was agreed that the organization should be informal, without regular constitution, by-laws, or dues and that meetings should be called by the President whenever entomological problems occurring in the Cotton Belt seemed to demand them.

The primary reasons for forming this organization were the common nature of the principal insect problems occurring throughout the Cotton Belt, and in which all Cotton Belt entomologists were, therefore, most keenly interested, and the further fact that many of these problems relating to cotton pests did not occur outside of the

Cotton Belt, and were, therefore, rarely dealt with in National Entomological meetings. Furthermore, National meetings are held most commonly in the Northern States and Southern entomologists found it difficult to attend them regularly. Therefore, it was felt that the organization of a Southern Association, including particularly all of the cotton growing states, would be of great help in promoting the solution of Cotton Belt insect problems, and that the more frequent meeting of entomologists working in the South, would really promote a deeper interest in the work of the American Association of Economic Entomologists, particularly.

The Association of Cotton States Entomologists did not hold annual meetings until after the boll weevil became established in the middle Gulf States, but from about 1916 to 1917 the spread of the boll weevil, the menace of the pink boll worm, the wide-spread occurrence of the Argentine ant, and similar problems, have led to annual gatherings. Several years ago the Association of Cotton States Entomologists became affiliated with the Association of Southern Agricultural Workers, as a section thereof and annual meetings have since been held at the same time and place as the annual meetings of the Agricultural Workers, with the programs printed jointly.

The interest in the meetings of the Cotton States Entomologists has grown steadily and attendance has frequently exceeded one hundred. At the Birmingham meeting, January 10 to 11, 1924, over one hundred were in attendance, and an excellent program was presented.

In making application to become a branch of the American Association of Economic Entomologists we believe that this recognition may properly be accorded to Entomological work in the Cotton Belt and that it would result in adding a measure of public recognition, and dignity to Entomology as an important and helpful profession which is a worthy vocation for an increasing number of well trained men, particularly those who have been brought up in the South and are familiar with its agricultural, social and economic setting as a background for entomological practice. We believe that this recognition will also serve to deepen the interest in the work of the National organizations; the American Association of Economic Entomologists, and the Entomological Society of America. We trust, therefore, that this application may meet with approval.

Approved:
/s/ W. E. HINDS
/s/ R. W. HARNED
/s/ G. M. BENTLEY

Respectfully submitted,
W. E. HINDS, *President*
R. W. HARNED, *Vice-President*
G. M. BENTLEY, *Secretary*
Officers of the Association of Cotton States Entomologists, 1925

After much discussion with reference to appointing "an advisory committee of entomologists and agronomists on research work in control of the corn borer," it was voted that a committee of five entomologists be appointed from this Association to act with five agronomists appointed by the American Society of Agronomists.

It was also voted that the application of the Cotton States Entomologists be accepted as a branch of the Association to be known as the "Cotton States Branch."

It was then voted that the report of the Executive Committee be adopted in its entirety.

ACTING PRESIDENT R. N. CHAPMAN: The next is the report of the Representative to the National Research Council. This report will be read by Secretary C. W. Collins.

REPORT OF THE REPRESENTATIVE TO THE NATIONAL RESEARCH COUNCIL

The National Research Council was brought into existence through the agency of the National Academy of Sciences in response to a widely recognized lack of organization of American scientific resources, which had become evident during the World War. In 1919 the Trustees of the Carnegie Corporation made available the sum of $5,000,000 to the National Academy of Sciences for the purposes of the Academy and the National Research Council to be used in the erection of a building suited to the needs of the two organizations and in the establishment of an endowment fund in support of the activities of the Council.

The policy of the National Research Council from the beginning has been to avoid operation as a laboratory institution, and to devote its efforts to organizing means of carrying out obviously needed lines of investigation. This effort has taken various forms—sometimes resulting in organizations like the Crop Protection Institute, sometimes definite laboratories for specific purposes, such as the Tropical Plant Research Foundation and still other times in means of publication, both of investigational results and of bibliographical records. As it was put by a member of the National Research Council "We push but if the pushing is being done by someone else we direct the course of the effort."

As you know from previous reports of your representative, this Society operates as a member of the Division of Biology and Agriculture. Relating to this Society, the Division has appointed a *Committee on Cooperation* with a membership almost identical with our *Committee on Policy* for the purpose of handling such problems of an entomological nature as come within the scope of this Division.

In the annual report of the Division of Biology and Agriculture occurs the following statement of interest to us:—"*Committee on Cooperation from the American Association of Economic Entomologists.* The American Association of Economic Entomologists still retains its Committee on Cooperation with the Division, although it is, at present, pushing no project under the auspices of the Division. Its main interest, at this time, is the Protection Institute."

The accomplishment that now stands to the credit of the Crop Protection Institute is one in which this Society can well feel pride but is there no other effort worth pushing under the auspices of the National Research Council?

From the standpoint of our Society, it is probable that the most important accomplishment of the Division has been its aid in bringing into actual operation the "Biological Abstracts Journal." Much of our entomological work is predicated upon the results of general biological investigations and a readily accessible summary, such as this JOURNAL promises to offer, should afford us much help. It is thought that the first issue will appear in 1926.

Considering the democratic and, consequently, somewhat unwieldy nature of the Research Council, its accomplishment in promoting research organization is truly

remarkable. Apparently, the moving spirits in this organization recognize that the true spirit of original investigation does not thrive under an autocratic regime, no matter how efficient in point of organization it may be, and have been very careful not to interfere with the liberty of the original investigator, even when such action entails to the administrative mind much apparent waste and loss.

THOMAS J. HEADLEE,
Representative of the American Association of Economic Entomologists to the National Research Council

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next report to be submitted is that of the Committee on Policy. Mr. A. F. Burgess is absent and the Secretary will read the report.

REPORT OF THE COMMITTEE ON POLICY

The following sub-committees have served during the current year:

RESEARCH: Messrs. Ruggles, Newell and Swaine.

PUBLICITY: Messrs. Collins, Felt and Ruggles.

INSECTICIDES AND APPLIANCES: Messrs. Parrott, Newell and Collins.

REGULATORY AND CONTROL: Messrs. Headlee, Felt and Swaine.

TECHNICAL TRAINING: Messrs. Gossard, Parrott and Headlee.

Aside from the matters considered by the sub-committees a number of other problems have required attention. Early in the year the President of the Association received a petition from the Association of Cotton State Entomologists to become a branch of this Association, to be known as the Cotton States Branch. This application was unanimously approved by the members of the Committee on Policy and was passed on to the Executive Committee for approval July 20, 1925. During May the Chairman of the Committee was advised by Dr. Felt that he had been notified that the publication of the American Yearbook which was discontinued in 1919 would be resumed and a volume published early in 1926. The management of the Yearbook is vested in a body of men representing a number of the more important national scientific and educational associations. Several years ago Dr. Felt was designated by the Executive Committee to represent this Association on the Board. In view of the fact that this appointment was continuous it seemed advisable for him to represent the Association until the end of the present year. It is understood that this publication will be continued permanently. The Committee on Policy recommends that the Editorial Board of the JOURNAL OF ECONOMIC ENTOMOLOGY designate a representative to serve on the Advisory Board of the American Yearbook.

The sub-committee on Publicity submits the following statement:

"The developments of the past year have indicated a somewhat general misunderstanding of some of the fundamentals in biology and in view of the fact that national prosperity depends to a very considerable extent on an appreciation of science and its possibilities, it is urged that entomologists as well as others should recognize their responsibilities in this direction and overlook no opportunity of inoculating the fundamental principles upon which depends practically all modern work in the biological sciences. It is believed inadvisable to enter the field of controversy or engage in biased propaganda. On the other hand, the repeated presentation of facts in their bearing upon present day methods can not but develop a more sympathetic attitude toward scientific work and more general toleration."

The sub-committee on Regulation and Control submits the following recommendations:

"(1) The annual meeting of the American Association of Economic Entomologists properly affords opportunity for the discussion of the nature and the merit of insect regulatory control and eradication proposals and should be utilized for that purpose.

(2) In view of the composition of its membership and the nature of most of the proposals, it is thought that the Section devoted to Horticultural Inspection offers the best forum for discussion of such matters.

(3) Disagreement among apicultural specialists and among practical beekeepers concerning the adequacy of knowledge relative to the eradication of American foul brood seems clearly to indicate that this project might profitably be made a theme of discussion before the Association.

(4) Formal action by the Association as endorsing or disapproving of insect regulatory control and eradication proposals is probably, except under very unusual circumstances, undesirable because the nature and composition of the Association will usually render substantial agreement of the entire membership, concerning any individual proposal of this kind, impossible."

The sub-committee on Insecticides and Appliances has a report to present to the Association which will be made separately.

Respectfully submitted,
A. F. BURGESS
J. M. SWAINE
ROYAL N. CHAPMAN
C. W. COLLINS
A. G. RUGGLES
Committee

Dec. 26, 1925.

After the reading of the report of the Committee on Policy, it was voted to adopt the report in general, excepting the recommendations embodied in the report of the sub-committee on Regulations and Control, which were set over for action at the final business session.

At the final business session recommendations 1 to 4 in the report of the sub-committee on Regulations and Control were discussed fully and it was voted that they be stricken out. This included the full report of the sub-committee on Regulations and Control.

The sub-committee report on Oil Emulsions was submitted to the Committee on Policy late in the evening before the business session of the Association and was not submitted in time for action by the main committee. The sub-committee report was read but no action was taken other than it be published in an early number of the JOURNAL. The report as published is therefore not a part of the main report of the Committee on Policy.

ACTING PRESIDENT R. N. CHAPMAN: The next report is that of the Crop Protection Institute.

CROP PROTECTION INSTITUTE

Report of Chairman of Board of Governors by W. C. O'Kane

Four new investigational projects have been begun in the course of the past year under the direction of the Institute.

Early in the year work was started on the study of certain spraying oils. This is financed with funds supplied by the Standard Oil Company of Indiana. The investigator in this project is Mr. L. L. English, and the work is being done partly at Urbana, Illinois, and partly at Vincennes, Indiana. The committee in charge of the project consists of W. P. Flint, Prof. John J. Davis and J. S. Houser.

The second project, undertaken early in the year, is a study of copper compounds, especially to develop a reversible colloid that might have advantages superior to Bordeaux mixture. Funds are supplied by the Nichols Copper Company, Goldsmith Bros. Smelting and Refining Co., and Balbach Metals Corporation. The investigator is Dr. Frank Wilcoxon and the headquarters of the project are at the Boyce Thompson Institute, Yonkers, N. Y. The committee in charge consists of Dr. William Crocker, Dr. R. W. Thatcher and Dr. N. J. Giddings.

In July an arrangement was entered into by which the Institute assumed one-half of the time of Dr. C. R. Orton, formerly of the Pennsylvania State College, to undertake studies in seed-borne parasites. Funds are supplied by the Bayer Company, Inc. The project has headquarters at the Boyce Thompson Institute. The committee consists of Dr. William Crocker, Prof. M. T. Munn and Prof. W. L. Burlison.

In August work was started on a study of the possibilities and limitations of the material known as "Flit," together with a comprehensive investigation of the action of various substances that may be used as constituents of such a compound. Mr. Franklin C. Nelson is the investigator and headquarters are at the New Brunswick, N. J. Experimental Station. The committee consists of Dr. T. J. Headlee, Mr. C. H. Hadley and Prof. W. C. O'Kane.

The study of Crown Gall is still under way. Two investigators are employed full time, including Dr. A. J. Riker and Dr. J. H. Muncie. Headquarters are at the University of Wisconsin and at the Iowa State College. The committee in charge consists of Dr. I. E. Melhus, Dr. G. W. Keitt and Dr. M. F. Barrus. Support of this project is provided jointly by the American Association of Nurserymen, by a voluntary committee of nurserymen, by the University of Wisconsin and by the Iowa State College.

The study of Scalecide continues. Mr. John W. Miller is employed full time on the project with headquarters at State College, Pa. In addition, work is in progress at Amherst, Mass., under the supervision of Prof. A. I. Bourne. The committee in charge consists of Dr. H. W. Thurston, Prof. P. J. Parrott and Dr. H. W. Anderson.

Research bulletins have been issued or are in press relating to the sulphur investigations, including a study of toxic effects on leaf tissue, and further data on new sulphur compounds.

The investigations of calcium arsenates have been concluded.

The study of furfural and its derivatives is completed as to its original plans but is being continued in other aspects.

Voted that the report be adopted.

An announcement was made by W. C. O'Kane after the reading of

this report that there would be an informal meeting of the Crop Protection Institute at the Hotel Baltimore at 8 o'clock that evening to discuss problems pertaining to their work.

ACTING PRESIDENT R. N. CHAPMAN: The next report is that of the Scientific Trustee, Tropical Plant Research Foundation.

Dr. W. D. Hunter acted as Trustee until the time of his death in October, at which time Dr. D. L. Van Dine was appointed to succeed him but no report has been received.

ACTING PRESIDENT R. N. CHAPMAN: We will now listen to the report of the Representative on the Council of the Union of American Biological Societies.

In the absence of Dr. Quaintance, no report was submitted.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the report of the Committee on Nomenclature.

In the absence of Chairman Edith M. Patch, Mr. Hyslop will read the report.

REPORT OF COMMITTEE ON NOMENCLATURE

Your Committee begs to report that during the past year it has continued to investigate usage in common names of insects and is submitting as the first appendix to the approved list of common names published in Volume 18, No. 3, of the JOURNAL OF ECONOMIC ENTOMOLOGY 92 names for your approval.

The Committee recommends that these names be submitted in mimeographed form to all members of the Association for their consideration and that all suggestions for emendation or change of these common names be directed to the Chairman of your Committee on or before April 15, 1926.

The Committee further recommends that all names to which less than 5 reasonable objections are made be considered as accepted by the Association as a whole, and that the list so abridged be published in the JOURNAL OF ECONOMIC ENTOMOLOGY in Volume 19, and that separates be issued and offered for sale by the Association.

You will recall that at the 34th Meeting of the Association held in Toronto in 1921–22, the present project of systematizing the common names was inaugurated. At the following meeting held in Boston, the Committee, presented a set of rules which was hoped would lead to a uniformity in the construction of common names. At the two subsequent meetings these rules were amended in those articles (4 to 9) which bore upon the use of the hyphen and the run-together. It finally became evident that generally applicable rules of this nature could not be made. The rules (1 to 4 and 10–12) of policy in making new names will continue to function.

Your Committee has attempted to conform to the expressed desire of the Association in the matter of reducing to a minimum the use of the hyphen, and you will note in the published list, and in the list which you will receive immediately following these meetings that the hyphen is only used in such cases as good English usage makes necessary. In the case of the run-together this is only employed where common usage makes it most advisable. No attempt has been made to follow any set

rules in the use of the hyphen in compound words, as to do so, would create many ridiculous words, or would necessitate numerous exceptions to the rules.

Your Committee strongly recommends that the members of the Association who are about to introduce a new name into the literature of economic entomology consult with the common name Committee. Your Committee now maintains a very complete file of common names that have been employed for insects, and by consulting with the Committee the use of the same common name for two insects may be avoided. The Committee will also appreciate receiving during the current year suggestions for additional common names which in the opinion of the members of the Association should be added to the approved list.

Very respectfully submitted,

E. M. PATCH — ARTHUR GIBSON
Z. P. METCALF — J. E. GRAFF
A. N. CAUDELL — S. A. ROHWER
J. A. HYSLOP *Committee*

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next is the report on Index III to Economic Entomology.

In the absence of Dr. Felt, Secretary C. W. Collins read the report.

REPORT ON INDEX III OF AMERICAN ECONOMIC ENTOMOLOGY

The compilation of the Index was made possible through the courtesy of Dr. L. O. Howard, Chief of the United States Bureau of Entomology. The work was done by Miss Mabel Colcord, Librarian of the Bureau and a number of assistants with the cooperation of Bureau experts in various lines. The 1588 pages of manuscript were received by the editor in early April and the last of that month were sent to the printer, the last proof being returned to the printer early in August and completed copies distributed about the middle of the month.

The Index speaks for itself. It was prepared along substantially the same lines as its two predecessors, marginal symbols or letters being used to indicate common names approved by the Association, articles containing descriptions of new species, illustrations and bibliographies. Condensed citations were tried in a number of cases where the species were of minor economic importance. An edition of 1000 copies was printed. The financial details are given in the report of the Business Manager of the JOURNAL.

There is a feeling among some at least that Biological Abstracts starting with the beginning of 1926 will cover the field occupied of late by the Index. It seems best to await developments and possibly at the end of the coming year, plan for a supplementary Index volume to cover 1925.

The Committee would remind members of the Association of their indebtedness to Dr. Howard and those members of the Bureau staff who have rendered such material assistance in the preparation of the Index, especially is this true of Miss Colcord and her assistants who did so much of the work.

Respectfully submitted,

E. P. FELT
C. W. COLLINS
W. E. BRITTON
Committee

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the Report of the Committee on U. S. National Museum.

In the absence of Chairman Felt, Dr. W. E. Hinds read the report.

REPORT OF THE COMMITTEE ON THE NATIONAL MUSEUM

There have been two very notable additions the past year to the collections of the Entomological Division. The collection of Coleoptera donated by the late Thomas L. Casey contains 6000 types of new species and should be made available to the specialists of the country.

We also note with pleasure the addition of the Dognin collection of Lepidoptera containing over 3000 American species represented by types and a donation second in importance only to the Casey collection. This notable addition was secured through the personal efforts of Dr. William Schaus who induced friends and acquaintances to contribute the sum of $50,000 for the purchase of this collection.

These very material additions to the National collections can not be commended too highly and should serve as an incentive to additional gifts of this nature, even though they may not be so extensive. It should be the ambition of American entomologists to make our National Museum a great repository for insect collections in this country and as such the center of entomological activities.

Accessions of this nature, past and future, impose upon the Museum an obligation to provide adequate care and curatorial services. The Casey collection is now closely crowded in a series of small boxes and therefore not available to students. We would therefore urge upon the authorities the need of providing for additional curatorial services and incidental expenses in relation thereto in order that these recent acquisitions may be put in the best possible condition for study.

Entomologists who may have opportunity to present the needs of the Museum to members of Congress may be able to render an extremely valuable service by calling attention to the importance of our national collections.

Respectfully submitted,
E. P. FELT
W. E. HINDS
R. W. HARNED
O. A. JOHANNSEN
HERBERT OSBORN
Committee

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next report is that of the Representative Appointed to attend the Association of Cotton States Entomologists.

In the absence of Dr. Newell, no report was presented.

ACTING PRESIDENT R. N. CHAPMAN: The next is the report of the Editorial Board as Advisory Committee to the Union of American Biological Societies.

In the absence of the chairman of the Advisory Committee, the report was read by Secretary C. W. Collins.

REPORT OF ADVISORY COMMITTEE TO UNION OF AMERICAN BIOLOGICAL SOCIETIES

Realizing the advantages of personal representation at an entomological center, your Committee took the liberty of requesting Dr. A. L. Quaintance to serve as our Washington representative. He has been in conference with various parties, notably Drs. Baker, Richardson and Rohwer, the committee representing the Federal Bureau of Entomology, in relation to the problems involved and with the cooperation of Miss Colcord he has prepared memoranda in regard to phases of economic entomology which might otherwise have been overlooked. We have the assurance of Dr. Schramm that everything possible will be done to include the literature of importance to the economic entomologists and nothing more can be accomplished along this line until abstracting has commenced and there is an opportunity of working out additional details.

The Committee has further cooperated in recommending entomologists to serve in various capacities in relation to Biological Abstracts and matters are developing in a very satisfactory manner.

It is recommended that the Committee be continued.

Respectfully submitted,
E. P. FELT
W. E. BRITTON
C. W. COLLINS
Committee

Voted that the report be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the report of the Endowment Committee. In the absence of Chairman A. F. Burgess, Secretary C. W. Collins will read the report.

REPORT OF THE COMMITTEE ON ENDOWMENT

Soon after the beginning of the calendar year I was requested by the President of the Association to take charge of the project of securing an endowment fund. While I firmly believe that this matter should be vigorously pushed, I do not feel that I am qualified to successfully handle this work. In order that there might be no delay in starting the project I consented to act as chairman of a small committee which included the President and Secretary, with the idea of presenting the matter to the membership in order to secure suggestions and so that a report could be made at this meeting.

Accordingly a circular letter was sent out on April 25 soliciting ideas and suggestions and calling attention to the fact that many of the members could materially aid this project by becoming life members of the Association. This requires the payment of $100.00 and carries with it exemption from dues and receipt of the JOURNAL OF ECONOMIC ENTOMOLOGY through life. Only a relatively small number of replies were received but all were favorable to the project and many contained useful suggestions for carrying on the work. Inasmuch as no opposition to the idea has reached the committee, it is believed that the members will give it hearty support.

An endowment fund is urgently needed by the Association. The membership is rapidly growing and the duties and responsibilities of the Secretary's office are increasing to such an extent that it will soon be impossible to manage the affairs of

the Organization under the present system. The permanent fund of the Association, which at the last annual meeting amounted to $2,373.08, should form the nucleus of the endowment fund. During the past year the Secretary has transferred from the Association fund to this fund $600.00, and fees for three life memberships amounting to $300.00 have also been added. These amounts together with the interest during the year have increased the fund to $3,389.01. Your committee believes that the Association should make every effort possible to increase this fund rapidly. As much money as can be spared after running expenses of the Association are paid should be transferred annually to this fund. More members should avail themselves of the opportunity of becoming life members and this plan should be facilitated by allowing payments to be spread over a number of years. Interest on all deposits should at the end of each year be placed in the permanent fund.

An examination of the financial condition of the JOURNAL OF ECONOMIC ENTOMOLOGY indicates that this publication has been able to meet its obligations and increase the number of printed pages per annum during the last few years. Inasmuch as the circulation is gradually increasing it is believed that the JOURNAL can be published and the number of pages further increased from the receipts from each current issue. Each year some back numbers are sold and it is suggested that the receipts from such sales be turned in to the permanent fund.

Under present conditions the committee feels that this is about all that can be done to aid the permanent fund directly from the Association or JOURNAL activities. A plan should be devised however, to approach non-members of the Association, particularly individuals who know of the important work that is done by the entomologists in protecting plant and animal products from losses by insects, and to interest them to assist the Association by making contributions to this fund. The committee feels that there must be thousands of people or organizations in the United States that would willingly assist if the matter was thoroughly explained by some one in whom they had full confidence. As a rule a committee cannot do this but the membership at large, if really interested in the welfare of the Association, should be able to accomplish much in this respect. For this purpose it is believed that if one member in each State would interest himself in this project, calling to his aid any other members that might assist, it should be possible to accomplish very tangible results.

Inasmuch as the permanent fund is likely to increase rather rapidly, it will doubtless be desirable for this fund to be administered by a Board of Trustees responsible for its investment who will make payments from it subject to the approval of the Association. An arrangement of this sort would relieve the Secretary of a growing financial care and appears to be a feasible way of safeguarding this fund.

The committee makes the following recommendations:

1. That the Secretary be authorized to transfer from the Association fund to the Permanent fund each year, such moneys as are not required to meet ordinary running expenses.
2. That the interest on all deposits be transferred annually to the credit of the permanent fund.
3. That members be urged to become life members, and to facilitate payment of the life membership fee, payments may be made as follows: Full payment $100.00; 2 payments to be made annually $52.00; 3 payments to be made annually $36.00; 4 payments to be made annually $28.00; 5 payments to be made annually

$23.20; Each member to be credited with life membership after full payment has been made. It is of course understood that life membership can be conferred only after favorable action by the membership committee and approval by the Association, and this membership like any other class may be terminated by the Association for unprofessional conduct without the return of the fee.

4. That funds received from the sale of back numbers of the JOURNAL OF ECONOMIC ENTOMOLOGY be transferred to the permanent fund.

5. That the Association create a Board of Trustees for the permanent fund who shall have charge of all moneys placed in this fund and be responsible for their proper investment. It shall make disbursements from this fund subject to the approval of the Association and shall make a report at the annual meeting. This fund shall be audited annually. The board shall consist of the President of the Association and three members elected for a term of three years, one member retiring annually. The terms at the first election shall be for one, two and three years, so as to make the retirement requirement effective. The Board shall select its own chairman.

6. That the present committee be discharged and a new committee appointed by the incoming President, to take charge of raising the endowment. It is recommended that the new committee designate a member in each State to secure funds for this purpose.

Respectfully submitted,
A. F. BURGESS
C. W. COLLINS
Committee

SECRETARY C. W. COLLINS after discussing the proposal No. 4 of the report with Dr. Felt, editor of the JOURNAL, stated that Dr. Felt was of the opinion that funds obtained from the sale of back numbers of the JOURNAL could not be better used than for the expansion and improvement of the JOURNAL.

After some discussion, it was voted that the report be accepted with the following reservations, i.e., that sections 1 to 6 of the recommendations be referred to the committee on policy for action at the next annual meeting.

ACTING PRESIDENT R. N. CHAPMAN: Last night we were delighted in having the privilege of seeing the photographs of many of the eminent European entomologists who attended the conference at Zurich, Switzerland. Dr. Howard will now read the report on the Third International Congress for Entomology.

THE THIRD INTERNATIONAL CONGRESS FOR ENTOMOLOGY

This congress was held in Zurich, July 19th to July 26th, 1925. The writer had the pleasure of being present as a delegate from the American Association of Economic Entomologists, the Entomological Society of America, the Entomological Society of Washington and the Bureau of Entomology of the U. S. Department of Agriculture.

The congress was largely attended by delegates from nearly all of the European

countries, the notable exceptions being France, Belgium, Italy and Russia. The writer was told by prominent entomologists in France that their absence from the congress was not due to international feeling, but to the unfortunate rate of monetary exchange. This general explanation was accepted by those present at the congress as fully accounting for the absence of delegates from the three countries just mentioned.

There was a notable attendance from Great Britain and her dependencies, more than fifty entomologists representing this part of the English-speaking peoples. From the United States there were only five. Those in addition to the writer were Prof. O. A. Johannsen, Dr. W. R. Thompson, Mr. S. M. Dohanian and Dr. E. Graenicher. There was a large attendance from Germany, Austria, Hungary, Holland, Sweden, Spain, and, naturally, from Switzerland. Denmark, Poland, Czechoslovakia, Finland and Esthonia were also represented. The writer was not able to get the full registration, but Mr. Charles Hose, who represented the Royal Colonial Institute of Great Britain, in an excellent account published in *The United Empire* for November, 1925, estimated it at 354. This, however, includes the ladies accompanying delegates.

The President of the Congress was Dr. A. V. Schulthess-Rechberg, a man of high standing and impressive personality, great tact and courtesy. The arrangements of the congress were admirable, and everything passed off smoothly. The Secretary, Dr. H. Kutter, is to be congratulated on the excellent results of his hard work. The admirable plan of program adopted at the two previous congresses was followed. On each morning there was a general session, with sectional meetings in the afternoons. For each of the general sessions there was an especial president, or chairman, and at these morning meetings, papers of general interest were read. The chairman of the general sessions, in order, were, the writer, Dr. A. Handlirsch, Prof. Ed. Everts, Prof. J. Jablonowski, and Prof. E. B. Poulton. Of the sectional meetings, Dr. R. Heymons was to have presided the first day over the section of Morphology, Anatomy and Physiology; Herr M. Schwartz over the section of Systematics and Geographical Distribution; Dr. G. A. K. Marshall over the section of Nomenclature and Bibliography; Prof. E. A. Carlier over the section of Biology and Evolution. At later sectional meetings Dr. Y. Sjöstedt presided over the section of Systematics and Geographical Distribution; Prof. J. F. van Bemmelen over Biology and Evolution; Prof. L. Reh over Applied Entomology. Still later Prof. R. Bledowski over the section of Biology and Evolution; Dr. R. S. MacDougall, section of Applied Entomology; Prof. W. Petersen, Systematics and Geographical Distribution; Father E. Wasmann, Nomenclature and Bibliography; Dr. J. Trägardh, Applied Entomology; Prof. G. H. F. Nuttall, Morphology, Anatomy and Physiology; Rev. G. Wheeler, Systematics and Geographical Distribution; Dr. C. Boerner, Biology and Evolution.

There were some admirable papers of broad bearing presented before the general sessions; for example, Prof. F. Ris, on "The Geographical Distribution of Insects in Switzerland;" Dr. R. T. Leiper, "Some Outstanding Questions in Medical Entomology;" Prof. E. B. Poulton, on a question of mimicry with certain African Lepidoptera; Dr. K. Escherich on "The Development of Applied Entomology in Germany;" Professor Pictet, on "Parthenogenesis and the Numerical Equality of the Sexes with Lepidoptera;" an important teleological paper by Doctor Handlirsch, and another by Professor van Bemmelen on mimicry, one by Doctor Trägardh, on some methods of research in forest entomology, another by Dr. G. Horvath on the distribution of Hemiptera; Mr. Balfour-Brown on the evolution of social life among

caterpillars, and still another by Mr. C. B. Williams on some unsolved problems of butterfly migrations,—all attracted much attention; while still another by T. Bainbrigge Fletcher on entomology in India, and one by Father Wasmann on mimicry between certain Staphylinids and their hosts, were listened to with great interest.

Applied entomology was recognized, as was naturally to be expected, as of rapidly increasing importance. In the special session just mentioned the papers by Escherich, Trägardh, Fletcher and Leiper dealt with economic matters. The meetings of the section of applied entomology were especially well attended. Important papers were read, by MacDougall on the ox warble, by Boerner on plant-lice, by Prell on the polyhedral diseases of insects, by Urich on economic entomology in the tropics, by Dampf on color changes in migratory locusts, and by Escalara on the introduction of gypsy moth parasites from Algeria. MacDougall also read a paper on the Coccid enemies of the banana. Dr. Leiper's paper on "Some Outstanding Questions in Medical Entomology," was, by the way, rather vigorously discussed since he had taken the stand that entomologists were apparently not taking sufficient interest in questions of medical entomology. This point was emphatically denied in the discussion by Doctor MacDougall, Mr. T. B. Fletcher and the writer.

While many languages were used, the predominating speech was either German or English. The English-speaking delegates were especially pleased by the opening remarks by Doctor Trägardh, who spoke in English and who stated in his opening sentence that, while he was sure that if he should speak in Swedish he would not be understood, he had the choice of German or English which he spoke equally well but chose to use English since he considered it to be a more nearly universal language than any other.

The language question is always a difficult one in an international congress; less so, perhaps, in scientific ones than in others, since we must all read almost all languages. But without calling on my reserve of anything but English I found that language spoken by very many Europeans, even by some who did not attempt its use at Oxford. Schultess, Wasmann, Trägardh, Jablonowski, Everts, Bolivar, Handlirsch, Spaeth, Kryger, Prell, van Bemmelen, Ris, Efflatoun of Egypt, Faes, Friederichs, Horn, Sjöstedt, and very many others spoke excellent English; while many more had enough to make themselves easily understood, although I doubt whether they fully comprehended the English papers and the discussions in that language. On the other hand, many of the English-speaking delegates were adept in German and some of the other languages. Nuttall and Urich appeared perfectly at home in that language and were of much assistance in the discussions and announcements. Hugh Scott of Cambridge seemed to speak any language fluently. And then there was an extraordinary young woman in the Secretary's office, Miss Kathe Biske who seemed perfectly at home in all languages. She is a student at the University of Zurich, and I understand is a Russian by birth.

There were a number of extremely pleasant social features, including the opening reception on Sunday night, July 19th, an excursion on Lake Zurich on Thursday afternoon, the 23rd, and a final dinner on the 24th which was very largely attended and at which many excellent speeches were made. After adjournment on Saturday, there were excursions to different parts of Switzerland.

The Executive Committee held frequent sessions during the meetings, and discussed many matters of broad interest to entomologists. It was decided to hold the fourth congress in 1928. The place was not chosen, but it was generally understood that if possible arrangements would be made to hold it in the United States. The

election of officers for the congress was left until the place should be decided. The only objection to the choice of the United States was a financial one. It was deemed certain that the attendance of European entomologists would be very restricted on account of the expense of the journey, and members of the Executive Committee expressed to the writer the hope that the American entomologists would be able to lessen the expense to European delegates in some way or another. A number of suggestions were made, but the matter was left in the hands of the entomologists of America.

There is some doubt as to the publication of the proceedings of the congress. At last information funds were lacking, and it is feared that the entomological world must wait at least for some months before it can read the papers and discussions. Doubtless many of the papers will appear in some of the periodical publications and doubtless also the conclusions of the Executive Committee will be published elsewhere. Of reports of the meeting, I know of five at this date of writing—one by Dr. R. Stewart MacDougall, in *Nature*, August 15, 1925 pp. 259–260; one by Mr. Charles Hose, already referred to, in *The United Empire* for November, 1925, pp. 682–684; one by the writer in the November number of *Entomological News*, and one by A. Müller in the *Zeitschrift für Angewandte Entomologie*, Heft 10, 1925 (rec'd Nov. 16), to be continued in future numbers of the same journal and one in the *Internationalichen Entomologishen Zeitschift* for Oct. 22, 1925 by A. Zerkowitz of Budapest.

Should the next congress be held in the United States, we shall not be in position to complain if there is a very small attendance of Europeans, since, of the five Americans at the Zurich congress, it is sad to relate that not one crossed the Atlantic especially for the congress, but all were in Europe for some other main purpose. The American leaders in entomology who were so much in evidence at the Oxford congress in 1912 (Comstock, Skinner, Holland, Calvert, Osborn, Kellogg, Forbes, Wheeler and Needham) were absent at Zurich and their places were not filled by others of the same prominence.

The writer was more impressed than ever by the value of these international meetings. Occasional personal contact is a great pleasure and an enormous stimulus. It is true that entomologists all over the world are a mutually helpful lot, but this desire to help becomes greater after personal acquaintance and conversation about details and conditions. While it is true that the old general attitude towards entomologists—of depreciation of his standing as a man of science—is rapidly passing away, the individual none the less is greatly encouraged to find himself one of a large group of men of similar tastes and to see what fine men they are. The extraordinary photograph which was taken of the congress shows a group of 250 people who would stand comparison with any other international group that could be selected.

L. O. HOWARD

Voted that the report be accepted.

A resolution was adopted that the Association favors the holding of the Fourth International Entomological Congress in America in 1928 and that a committee of three be appointed by the incoming President to consider the matter of possible arrangements.

ACTING PRESIDENT R. N. CHAPMAN: We have with us today another

man who has represented us at a Congress. We will now hear the report of the Second Conference of Imperial Entomologists.

REPORT OF THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE HELD IN ENGLAND, JUNE 9–18, 1925

By ARTHUR GIBSON, *Ottawa, Canada*

The Imperial Bureau of Entomology, as many of you know has its headquarters in London, England. The office of the Director, Dr. Guy A. K. Marshall is in the South Kensington Museum of Natural History and that of the Assistant Director, Dr. S. A. Neave, at 41 Queen's Gate, nearby, in the building owned by the Entomological Society of London.

The Honorary Managing Committee of the Bureau consists of well known entomologists and other scientists resident in England, as well also as the Chief Entomologists in each of the self-governing Dominions. The Earl Buxton is Chairman of the Committee.

At the First Imperial Entomological conference held in June, 1920, it was resolved that similar conferences be held in London once in five years. 1925, therefore, was the year for the Second conference and the Secretary of State for the Colonies issued invitations to the overseas Governments to send representatives to convene on June 9.

As a consequence the following delegates were in attendance.

T. J. Anderson	representing	Kenya
L. D. Cleare	"	British Guiana
Hon. H. P. Colebatch	"	Western Australia
Rt. Hon. Sir Joseph Cook	"	Commonwealth of Australia
G. H. Corbett	"	Strait Settlements Federated Malay States
T. Bainbrigge Fletcher	"	India
Arthur Gibson	"	Canada
E. E. Green	"	Ceylon
H. Hargreaves	"	Uganda
H. H. King	"	Sudan
G. H. Knowles	"	Gold Coast
C. P. Lounsbury	"	Union of South Africa Southern Rhodesia Basutoland Swaziland Bechuanaland Protectorate
J. G. Myers	"	New Zealand
A. W. J. Pomeroy	"	Nigeria
J. G. Rhynhart	"	Northern Ireland
D. W. Scotland	"	Sierra Leone
E. J. Sheehy	"	Irish Free State
Lt. Col. R. E. Snowden	"	Tasmania
C. F. M. Swynnerton	"	Tanganyika Territory
F. W. Urich	"	Trinidad
Prof. Warrington Yorke	"	Northern Rhodesia

Some little time before the conference I received a letter from the late President Gossard asking me to extend to the delegates present, very warm greetings from the

members of this Association. This I was very pleased to do. I was requested to convey to the American Association of Economic Entomologists, in return the thanks and good wishes of those who attended the Imperial Entomological Conference and this, Mr. Chairman, I have much pleasure in doing now.

It was a great privilege to meet the overseas entomologists of the British Empire as well as many men of science in England who attended the various sessions. One of the important features of the conference was undoubtedly the establishment of personal contact with the men working in the various parts of the Empire.

At the opening session, on June 9, Dr. Marshall presented an interesting statement on "The Work and Finances of the Imperial Bureau of Entomology." This showed that the Bureau financially and otherwise is now in a very satisfactory condition. The annual contributions now being made to the Bureau by the various Governments concerned is in the neighborhood of £12,000. Many letters of appreciation have been received regarding the excellence of the publications issued by the Bureau, namely the Review of Applied Entomology, and the Bulletin of Entomological Research.

During following sessions, a number of important papers were given and abstracts of these have appeared in the official report of the conference published by His Majesty's Government.

Altogether the conference was a decided success. By arrangement, visits were made to Oxford, Cambridge, Rothamsted, and other centres where much entomological work of a very high character has been accomplished. A joint outing of the entomologists in attendance and members of the Association of Economic Biologists to the famous Bunyard Nurseries, Maidstone was also held.

On the evening of June 18, the last day of the conference, His Majesty's Government gave a dinner at Lancaster House in honor of the delegates. The Rt. Hon. L. C. M. S. Amery M. P., Secretary of State for the Colonies, presided. This was a most interesting state function and in addition to the delegates attending the conference, a number of men, eminent in science, had been invited. Your representative, if I may so term myself, being the official delegate from the senior overseas Dominion, had the seat of honour at Table No. 1 and responded to the toast to the delegates.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the appointment of committees. It happens that of the committee on membership, which is a standing committee, there is but one member present. Apparently it is within my constitutional rights to appoint members pro tem. Consequently I will appoint to act with W. P. Flint as members pro tem for this meeting, Lawson Caesar and R. W. Harned. For the committee on nominations I will appoint M. H. Swenk, H. G. Crawford and G. M. Bentley. For the committee on resolutions I shall appoint W. B. Herms, S. B. Fracker and J. G. Sanders.

Is there any miscellaneous business to come before the meeting at this time?

Is there any new business?

MR. W. E. HINDS: In regard to the matter of the acceptance of the Cotton States Entomologists as a Branch of this Association, I would

like to express the appreciation that we feel for that recognition of southern entomological work in behalf of that Association. Our meeting for 1926 will be held at Atlanta, Ga., February 3 and 4 at the Biltmore Hotel. I should like to extend an invitation that this Association send some delegate to attend that meeting with us.

ACTING PRESIDENT R. N. CHAPMAN: We thank you for your expression and I assure you I can convey to you a welcome from our Association. We are glad to have you united with us.

Acting President Chapman then announced that the Executive Committee would like to call attention to the condition of the program at this time. According to the roll approximately 25 authors are absent, each involving a paper of about 10 minutes in length, meaning that the reading time of the program would probably be cut down about 4 hours. It was suggested that inasmuch as there were 4 papers scheduled to come on Saturday morning it would be possible to move the program forward in such a way that it would be ended by Friday evening.

After a full discussion concerning changing the program in order to finish by Friday evening late and the influence that this would have on the attendance at the entomological dinner Friday evening, it was decided to continue the program as arranged and take up the matter later in the day.

ADJOURNMENT: 12:10 p. m.

FINAL BUSINESS

The final business was transacted Friday afternoon, January 1, 1926.

ACTING PRESIDENT R. N. CHAPMAN: The first order of business will be the report of the Committee on Resolutions.

REPORT OF COMMITTEE ON RESOLUTIONS

Resolved That:—1. Through the untimely death of our President, Professor H. A. Gossard, this Association, as well as our profession in general, has suffered a great loss, and we will miss his friendship, his excellent personality and sincere leadership, and it is desired that the Secretary forward a copy of this resolution to the family, expressing the sympathy of this Association.

2. The sudden death of Dr. W. D. Hunter has removed from active work in Entomology one of our distinguished leaders and former President of this Association, whose interest was centered not alone in southern field crop insect investigations, but also in the development of Medical Entomology.

3. We express our thanks to the Local Committee in charge of arrangements for the Kansas City meeting for the entertainment which they have arranged for the members.

4. We express our appreciation of the facilities afforded the Association at this meeting by the Kansas City School of Law.

5. A standing committee on Insect Pest Survey which shall advise and cooperate

with the present Survey, be established, consisting of five members representing the East, West, South, Central and Canadian areas.

6. A standing committee on program consisting of three members be appointed by the President for the purpose of considering the improvement of our programs to cooperate with a similar committee of the Entomological Society of America which that Society is invited to appoint.

7. We urge the establishment by the United States Bureau of Entomology of foreign field stations wherever advisable for the study of problems pertaining to insects already introduced or likely to be introduced into this country.

8. We commend the action of the Secretary of Agriculture in supporting Quarantine 37.

9. We appoint a committee to investigate arsenical residues on fruits as the result of spray programs.

10. Exhibits of new pests, new control methods, new apparatus and appliances, or other features in the field of economic entomology are desirable features in connection with our annual meetings and provision should be made for such exhibits.

11. Since the copyright laws are for the protection of authors and writers, this Association urges its representatives to aid in any way possible the obtaining of rulings or legislation protecting mimeographed or otherwise multigraphed material equal with printed texts, and that this matter be referred to the Executive Committee with power to act.

Respectfully submitted,
W. B. HERMS
J. G. SANDERS
S. B. FRACKER
Committee

It was voted that the first four sections of the report be adopted. The remainder of the report was taken up and disposed of by sections and voted upon separately.

After discussion section 5 was amended to read as printed in the above report and finally adopted in this form.

It was brought out in the discussion on section 6 that a committee should be appointed to consider improvement of the program. This section was discussed at length with an attempt made to prescribe the exact duties of such a committee but the section was finally adopted in its amended form as given in the above report.

Section 7 was adopted without discussion further than it was stated by W. B. Herms that a similar resolution was proposed and adopted by the Entomological Society of America.

Section 8 was adopted without discussion.

Section 9 was amended so that a committee would be appointed to bring together and present all the evidence on arsenical residues on fruits.

After some discussion it was voted that the exhibits called for under

Section 10 be made available in close proximity to the meeting places of our main Association and Sections.

It was voted that Section 11 of the report be adopted.

It was then voted that the whole report be accepted.

ACTING PRESIDENT R. N. CHAPMAN: The next report is that of the Committee on Membership.

REPORT OF COMMITTEE ON MEMBERSHIP

The committee on membership submits the following report:

1. It recommends for election to associate membership the following 78 persons:

Allen, Norman	Gates, Leroy M.	Painter, R. H.
Arnold, Thomas A.	Glance, Grace E.	de la Parelle, H. J.
Armstrong, George M.	Gui, Harry L.	Reid, W. J., jr.
Atwell, H. C.	Guyton, F. E.	Roesling, C. F.
Baker, William A.	Harman, John H.	Rude, C. S.
Baird, Alfred B.	Hartnack, Hugo	Russell, E. E.
Bare, Olando S.	Hill, Alva C.	Sazama, R. F.
Botsford, Robert C.	Hoerner, John L.	Schenk, Gilbert
Boyd, George W.	Jacobsen, W. C.	Schlosberg, Morris
Boyd, Mark F.	Jones, Merlin P.	Schweiss, G. G.
Brown, Raymond C.	Johnson, A. C.	Scott, L. M.
Butler, Harold G.	Johnson, Karl W.	Sheppard, R. W.
Carter, Walter	Johnston, H. Bennett	Shirck, F. H.
Chamberlain, W. J.	Keenan, William N.	Shoemaker, Amalia J.
Cleavinger, Eugene A.	Kellogg, Claude R.	Stevenson, W. A.
Daniel, Derrill M.	Kelsheimer, Eugene C.	Stone, W. E.
Davis, M. H.	Kislanko, J. P.	Stellwaag, Dr. Friedrich
Deen, R. B.	Marvin, George E.	St. George, R. A.
Dustan, Alan G.	Miller, Ralph L.	Todd, J. N.
Dutton, W. C.	Mills, Alfred S.	Wall, R. E.
Ewing, K. P.	Mills, James	Whitcomb, Warren, jr.
Faxley, James N.	Mortensen, E.	Whitehead, F. E.
Folsom, J. W.	Munro, J. A.	Willard, H. F.
Fey, K. Y.	Osburn, M. R.	Williams, V. V.
Fowler, W. A.	Osburn, R. H.	Williams, G. R.
Gaines, R. C.	Peters, H. S.	Zeimet, Carlo

2. The committee recommends that the following 26 associate members be transferred to active membership:

Chapman, J. W.	Goodwin, J. C.	Parker, H. L.
Colcord, Mabel	Hoffman, W. E.	Phipps, Clarence R.
Culver, J. J.	Hough, W. S.	Rosewall, O. W.
Cutright, C. R.	Jaenicke, A. J.	Simmons, Perez
Detwiler, J. D.	Lane, M. C.	Spencer, G. J.
Doucette, C. F.	Maheux, Georges	Whelan, Don B.
Dunnam, E. W.	Miller, A. E.	Young, M. T.
Faxon, Richard	Montgomery, J. H.	Yuasa, Hachiro
Frison, T. H.	Ness, Henry	

3. The committee recommends that the following persons be re-instated in the Association:

Cassidy, T. P.	Morris, Earl L.
Moreland, R. W.	Vansell, G. H.

4. The committee recommends that the resignations of the following members be accepted: (all associate)

Dye, H. W.	Richardson, T. R.
Giffard, W. M.	Taylor, L. H.

5. And finally the committee recommends that the 18 active and 28 associate members who are in arrears for dues for two years past be notified that if these dues are not paid within a reasonable time, the Secretary be instructed to drop the names of those members from the roster of this Association.

Regulation Regarding Delinquent Members

The Membership Committee holds that membership in the American Association of Economic Entomologists is not a matter to be taken lightly and dropped at will, simply by the non-payment of annual dues. In case a member wishes to discontinue his membership or his subscription to the JOURNAL, he should notify the Secretary to that effect and pay all dues and subscription to the JOURNAL up to the time that he wishes his membership to cease and the JOURNAL subscription to expire. Due action on his membership will then be taken at the next annual meeting of the Association. Later if he wishes to be re-instated, he can make application to that effect and will have no back bills to pay. The following procedure is recommended:

All members who have been dropped for non-payment prior to January 1, 1926, and wish to be re-instated shall be required to pay all dues that have accrued to the time they were dropped together with their indebtedness to the JOURNAL OF ECONOMIC ENTOMOLOGY as shown by the Secretary's books, also dues and subscription for one year in advance.

After January 1, 1926, it shall be the duty of the Secretary to notify all members who are in arrears for one year that unless full payment is made within the current year, their names will be dropped from the rolls.

Members dropped for this reason must accompany their application for re-instatement with twelve dollars ($12.00) which will cover back indebtedness and cost of dues and JOURNAL for one year in advance. This payment shall entitle the applicant to be furnished with such copies of the JOURNAL for the years concerned, as the Secretary's record indicates have not been previously supplied. All such applications for re-instatement must be referred to the Membership Committee for consideration and reported at the annual meeting.

Respectfully submitted,

W. E. BRITTON, *Chairman*
W. P. FLINT
HARRY S. SMITH
R. W. HARNED, pro tem.
LAWSON CAESAR, pro tem.
Committee

It was voted that the recommendations in regard to membership be adopted.

The report was then discussed and it was voted to strike out from it that part pertaining to recommendations for life membership, it being the sense of the meeting that the mere tendering of a check for $100 entitled any member to life membership in the Association.

The recommendations in regard to delinquent members were discussed at length—especially the last section which calls for $12 to be paid as a re-instatement fee. It was finally voted that the recommendations with reference to this re-instatement fee be referred to the Executive Committee with power to act after consulting an attorney to find out whether the Association is legally correct in the matter.

It was voted that the entire report and recommendations be adopted.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the nomination of JOURNAL officers by the Advisory Committee.

MR. E. N. CORY: The committee feels that we would go very far to find a better editorial management and business management and therefore nominates the present incumbents: Dr. Felt, as Editor; Dr. Britton, as Associate Editor and Mr. Collins as Business Manager.

In addition there are two members of the Advisory Committee to be elected and for these two positions the committee wishes to nominate J. I. Hambleton, Washington, D. C. and W. B. Herms, Berkeley, Calif. —terms to expire 1928.

It was voted that the report be accepted and the nominees elected.

ACTING PRESIDENT R. N. CHAPMAN: The next order of business is the report of the Committee on Nominations.

REPORT OF THE COMMITTEE ON NOMINATIONS

Your committee appointed to nominate officers for the American Association of Economic Entomologists for the year 1926, respectfully reports as follows:

President, Arthur Gibson, Entomological Branch, Ottawa, Canada.

First Vice-President, C. J. Drake, Iowa State College, Ames, Iowa.

Second Vice-President (Pacific Slope Branch), W. B. Herms, Berkeley, Calif.

Third Vice-President (Section of Plant Quarantine and Inspection), L. A. Strong, Sacramento, Calif.

Fourth Vice-President (Section of Apiculture), J. I. Hambleton, Washington, D. C.

Fifth Vice-President (Cotton States Branch), W. E. Hinds Baton Rouge, La.

STANDING COMMITTEES

Policy, L. Haseman, Columbia, Missouri.

Membership, J. A. Hyslop, Washington, D. C.

National Museum, J. J. Davis, Lafayette, Ind.

Representative to National Research Council, T. J. Headlee, New Brunswick, N. J.

Councillors to American Association for the Advancement of Science, G. A. Dean, Manhattan, Kansas; W. E. Britton, New Haven, Conn.

Trustee for Crop Protection Institute, P. J. Parrott, Geneva, N. Y.

Representatives on Council of Union of American Biological Societies, A. L. Quaintance, Washington, D. C.; C. R. Crosby, Ithaca, N. Y.

Representative on Board of Trustees of Tropical Plant Research Foundation, Herbert Osborn, Columbus, Ohio.

Respectfully submitted,

H. G. CRAWFORD
G. M. BENTLEY
M. H. SWENK, *Chairman*
Committee

MR. M. H. SWENK: The Committee on Nominations was not quite sure as to whether it was part of its duty to nominate for the Advisory Board of the JOURNAL. It made certain nominations. However, I gather from the nominations just received that that belongs to the province of another committee, so I will not present those names.

It was moved and seconded that the Secretary cast the ballot and the officers named in the report were declared elected.

ACTING PRESIDENT R. N. CHAPMAN: I will now ask that Past Presidents Sanders and Dean escort the President-elect to the Chair.

(Past Presidents Sanders and Dean escorted President-elect Gibson to the Chair.)

ACTING PRESIDENT R. N. CHAPMAN: Mr. Gibson, it gives me great pleasure to turn over to you the business of the Association.

PRESIDENT-ELECT ARTHUR GIBSON: Members of the Association: This has come to me as a great surprise. I had absolutely no idea that such an honor would be bestowed upon me today. I don't know that I have anything special to say at the present time. Under the circumstances, you can understand it is hard to make many remarks. You may rest assured, however, that I shall have the interest of the Association at heart and that I shall do everything I possibly can during the coming year.

I thank you very much indeed for this honor. (Applause)

The next item on the program is Miscellaneous Business. Has any member of the Association any matter to bring before the members?

MR. C. L. METCALF: There is one matter I think that ought to receive some consideration for the next meeting. The well-nigh perfect arrangements for this meeting have been seriously hampered all through the meeting by the idea on some one's part that a 3 x 4 Trans-Lux screen is a substitute for the large screens which we have had in former years. I don't know what the proper procedure would be, but I should like to suggest that the Secretary see that we have, if possible, a screen of proper size for projection in future meetings.

PRESIDENT-ELECT ARTHUR GIBSON: It seems to me that the suggestion is a very excellent one. I felt the need of such a screen during the meeting.

The next item of business is fixing the time and place of the next meeting. As all of you know, the American Association for the Advancement of Science is meeting in Philadelphia next year.

SECRETARY C. W. COLLINS: Mr. Chairman, I move that this Association meet at the same time and place as the American Association for the Advancement of Science.

The motion was seconded and carried.

PRESIDENT-ELECT ARTHUR GIBSON: Are there any other matters that any one desires to bring up before the meeting adjourns? If not, I will declare the meeting adjourned.

ADJOURNMENT: 5:15 p. m.

PART II. ADDRESSES, PAPERS AND DISCUSSIONS

Thursday Afternoon Session, December 31, 1925, 1:50 p. m.

The meeting was called to order at the above time by Second Vice-President, Leroy Childs.

SECOND VICE-PRESIDENT LEROY CHILDS: It is regrettable that our elected President cannot be with us at this time but during the past year he accumulated a manuscript in part which he desired to present at this meeting. Our First Vice-President, Dr. R. N. Chapman, has compiled the information that President Gossard prepared and will deliver his address from that compilation.

(Dr. Chapman read the annual address of President H. A. Gossard.)

ORGANIZATION AND PROGRAM PROCEDURE

By H. A. GOSSARD

For more than thirty-five years this Association has operated under a plan of organization and of program procedure that has been remarkably successful. Most of us, as members, have assumed that nothing could be more satisfactory than our general condition, that no changes were needed, that the officials knew no embarrassments—everything was going and would continue to go as happy as a marriage bell.

It was only when the responsibilities of the Presidency were laid on me that I realized that there must come within a very few years im-

portant modifications in our program and business procedure, possibly a complete reorganization of our plan of work. When our membership was much smaller than now, it was desirable to receive for reading at our annual meeting all papers that were offered, but with the increase in membership we have been obliged to progressively limit the time for reading until in many cases the presentation is now a short abstract and at our last meeting in Washington discussion was practically eliminated. Expressions of dissatisfaction and of perplexity soon began to reach me as President with various suggestions for overcoming the embarrassment. Some members advocated gaining time by overlapping on the program of the Entomological Society of America and continuing to receive all papers offered. Some wanted five-minute abstracts and the reading followed with about an equal amount of discussion. Another member suggested that each group of papers relating to cereal insects, truck insects, fruit insects, forest insects, etc., as made by the Secretary in recent years, be regarded as a sectional program and that two or more of such programs be given simultaneously in different rooms. Another wanted our entire program made up of symposia or invitation programs, the speakers to be invited by authorized officials. Another suggested that no one be allowed to appear on the program except at long stated intervals, perhaps once in four or five years. Every plan submitted has appeared to me to have grave defects and I have not been able to formulate any plan myself that is obviously better than, if as good as those mentioned. All have grave defects and we will likely be obliged ultimately to adopt the one which appears to be less objectionable than the others. If we proceed as at present, accepting all papers that are offered and try to meet the expanding demands for time made by our two recognized sections, no matter how we limit discussion nor how we overlap on the programs of the Entomological Society of America, we shall soon find our wearisome program crowded up against both ends of the week and doubling back on itself somewhere. The only way to prevent this would be by rejecting some of the papers offered, but to organize a program committee that could find time to look over all the papers and decide which to accept and which to discard and also to get the program printed in the December number of the JOURNAL seems impossible. No one individual, and possibly no committee, would accept such a thankless task and unless the entire committee resided at the same place, such a review would be impossible. Limiting each member to an appearance on the program once in each four or five years has also been suggested. The difficulty here is that any member might have a much more important paper during the years when ruled out than during the

years when he had a right to appear. He might refuse to appear at all at the time when entitled to recognition.

The distinct specializing tendency of present day studies has also set in motion certain centrifugal forces which will certainly disintegrate our organization unless we assume a timely control. Organized ecology has already escaped from us and the section of Horticultural Inspection may do so if not accommodated with more time for its programs. We have had to grant this to the Horticultural Inspection Section for this session. Other specialized groups interested in such subjects as physiology, extension, genetics, etc., are gradually becoming more clamorous for opportunities to associate themselves together so they can in common thresh out their problems of mutual interest. Unless we can provide in some manner for the needs of these groups we must not expect their continued allegiance. How to organize the very diverse expert entomologists of America, over eight hundred in number, so as to satisfy the demands of specialization and yet give to both old and young members an easily recognized share in the benefits to be gained from membership, is the task confronting us. Our Association from the beginning has emphasized applied entomology and no matter what form of organization we adopt, we must preserve this feature of our work or lose to some degree the sympathy of the public and the loyalty of our members. But in addition to our activities of a practical or economic nature, it is also desirable that our midwinter meeting should stand for and speak for a complete entomology with its various technical phases all represented. Certainly most of us agree with Dr. L. O. Howard's frequent declaration that "all entomology is economic." To speak for and to provide for the more technical phases of entomological science which our Economic Association has always to some degree neglected, the Entomological Society of America was organized in 1906 and for several years our two Societies, working cooperatively, have spoken more effectively for American entomology than any other entomological organizations. Our sister Society, following the same program plan as ourselves, also uses more time than formerly and with both Societies following this plan it is now no longer possible to avoid simultaneous readings in the two Societies.

Until within the last year or two, both Associations have had what I may call straight line or tandem programs, one of them beginning Tuesday morning and ending Wednesday evening, the other commencing Thursday morning and terminating Saturday afternoon. Only during the last two or three years has it been necessary to have overlapping or

simultaneous programs, thus putting different phases of our work into competition. It is evident that if we were to arrange two straight line programs, each beginning Tuesday morning and ending Saturday, we would double or nearly double our program capacity, and if we were to have three sections simultaneously, we would nearly treble it. To double our capacity we would need two rooms and to treble it we would need three.

While it may be best to urge upon some of the sections that their programs be made up in part or chiefly of symposia, it would seem best to allow each sectional program committee considerable discretion as to the make-up of its programs, for some of them will be able for a few years at least to receive the papers voluntarily offered and others may wish to receive short abstracts and discuss them.

I recommend that a committee be appointed from this Association to meet with a similar committee from the Entomological Society of America, if such is appointed upon our invitation, to consider this and all other plans and suggestions for future program procedure which may be received from any of our members during the coming year; and that this joint committee make, if possible, recommendations at our next annual meeting. Some members insist that we must not have many sections running simultaneously, and yet others that we must accept all papers offered. These two requirements cannot be reconciled. Forty linear inches cannot be crowded into one linear foot. We must have a number of sections running simultaneously or else a complete revolution in program procedure. To obtain the rich experience of the older men and at the same time preserve individual initiative and also give our young men a chance to appear, we must have some such arrangement as I have outlined. Unless we get a less congested program than we now have, many of our members will transfer their first allegiance to the regional branches. We must encourage the formation of these branches whether or not they affiliate with our general Association.

The acceptance of new regional branches and the organization of sections will mean that we cannot possibly publish in the JOURNAL all the matter that will be read at the various meetings and this is not really necessary. Many papers will be published by the Federal Bureau or in Experiment Station bulletins and such need not appear at all in the JOURNAL while others can be boiled down to abstracts. When the Editorial Board has determined how much matter can be printed for the year, a fixed percentage of this can be reserved for the midwinter program and divided among the sections according to some acceptable

method of computation, and a definite percentage of the whole can also be assigned to each regional branch. Each regional Branch and each section can and should have a publication committee which will decide which papers shall be published. The editor should not be loaded with this responsibility. Of course, there should also be an attempt to expand the JOURNAL through an endowment.

I further recommend that action taken some years ago by our Association to prohibit non-members from appearing on our program when invited by proper officials be repealed. It now works out in such a mischievous way that the men who know most about very technical subjects, such as the chemistry of insecticides, cannot appear. We are deprived of the new knowledge they could offer or else they are obliged to surrender it to cooperating entomologists who by presenting this new knowledge under their names would acquire a credit not belonging to them. It is practically impossible to have a symposium on insecticides at the present time. For example, I attempted to arrange for a symposium on insecticides for this session and sent out invitations to several men who were known to be especially proficient in the subjects I wanted discussed. Most of them were willing to participate but some were working cooperatively with chemists in the Bureau of Chemistry on their projects and it was part of the cooperative agreement that neither Bureau would give out any information without the consent of the other. It seemed utterly inconsistent to ask the chemists in chief charge of these investigations to turn over their results to the cooperating entomologists and allow publication under the names of the entomologists, no matter how careful these entomologists might be to explain how the work was done. The only way to get an authoritative, satisfactory presentation and discussion of such an investigation is to have the man in chief charge of the work appear on the Association program whether he is a member or not. Under the legislation in question symposia can hardly be arranged at all on chemical subjects, and none of the most distinguished entomologists of Europe, not members of our Association, could lawfully appear on our programs no matter by whom invited nor how anxious our members might be to hear them.

After the memorial service (see page 194), the meeting was called to order at 2:30 o'clock by Mr. Leroy Childs, Second Vice-President.

SECOND VICE-PRESIDENT LEROY CHILDS: The first paper on the program is by D. M. DeLong.

CONTROL MEASURES FOR THE HOUGHTON GOOSEBERRY APHIS WITH SPECIAL REFERENCE TO PLANT RESISTANCE

By D. M. DeLong and Merlin P. Jones,
Columbus, Ohio

Abstract

A three-year study of this pest, *Myzus houghtonensis*, has shown that although engine oil emulsion, miscible oil, nicotine or a combination of either oil with nicotine will kill the hatching aphids and prevent formation of galls, it is almost impossible to obtain a practical control since the aphids migrate from plant to plant in the third seasonal generation and multiply rapidly after the migration. A strain of plant apparently resistant to their attacks gives greatest promise as a method of control. For three years these plants have been uninfested and aphids transferred to them did not injure them. Horticulturists have not been able to distinguish these from the houghton gooseberry plants which are infested. Several parasites were reared from these aphids but no marked degree of control was noted.

During the past three years while studying the Houghton Gooseberry Aphis as a pest in Ohio the writers have made repeated attempts to devise measures to control it. To this end work has been carried on along two lines especially, first a rather detailed life history study with a view to obtaining if possible a place in the cycle where control would be most effective, and secondly the use of different spray materials in order to obtain their relative values as controls. Several standard spray materials have been used, including engine oil emulsions, miscible oils, and nicotine sprays as well as a combination of oil and nicotine. A resume of the life history data has already been presented before this society in a previous report.

Observations show that the overwintering eggs hatch before the first leaves are showing conspicuously in the bursting buds and the young begin feeding immediately upon the first leaves that appear. The galls, which are formed rapidly by this immediate feeding, protect the aphids during the entire growing season from injury by spray materials. It is therefore necessary to attack them early and within a very limited period if sprays are to be used. It was found best to apply spray materials at the time of the hatching of the eggs when the aphids were becoming active on the vines and were seeking out the opening buds. Some of the eggs will not have hatched but usually a time can be determined when all will either have hatched or be in the process of hatching. This date was determined by actual observations of overwintering material and for the benefit of the grower this hatching data was correlated with plant development. For the past season April 9 was considered the best date for spraying and at this stage of development dormant strength sprays can be used without injury.

The materials which were used that gave the best results as sprays during this study were nicotine sulphate 1 to 500; a 2% engine oil emulsion (104 at 100-paraffine base); miscible oil 1 to 15 and combinations of miscible oil and engine oil emulsion each with nicotine 1 to 1000. All of these materials alone and in combination were quite effective in killing the hatched and hatching individuals and consequently preventing the formation of the new galls. The control was so complete in some cases that it was necessary to hunt carefully in order to find a single gall on many plants in the treated plots while others were apparently free from infestation. The adjoining check rows showed thirty or more galls per plant. If any distinction could be made between these materials, it was where nicotine was used alone or in combination, but the percentage of increased killing was so small, five per cent or less, that it could not be considered as being superior economically, especially when cost is considered. The difficulty encountered in an attempt to control this aphis by spraying is the same problem as that frequently found when working with other aphids of economic importance. The third generation in the spring is winged, and migrating aphids occur on the wing the latter part of May or early in June. The species apparently does not have an alternate food plant since the migrating aphids reinfest the plants and are extremely difficult to combat at this time or later. The problem of control with spray materials, if successful, is therefore a complete extermination of the young aphids hatching in the spring before the galls are formed, which is almost impossible. Especially is this very difficult in view of the fact that the eggs are well concealed in the debris at the base and that the hatching aphids make their way first in the majority of cases, to the young tender shoots coming from the roots. Consequently the first galls are close to the base of the plant, where, under normal conditions, grass, old leaves, and other forms of vegetation and debris are found. On the other hand the terminal galls are formed to a large extent by aphids of later generations or migrating forms. In spraying work it is therefore necessary to drive the spray well into the small shoots at the base and lower portions of the plant in order to effect control.

In this connection it should also be stated that twigs containing aphid eggs were not dipped in spray solutions to determine the percentage of killing, but sprays were applied in a commercial planting under field conditions so as to make the tests practical and to prevent misleading or theoretical conclusions. Under conditions used in these experiments there could be no chance of the formation of a film of oil on the surface

through which the eggs were dipped, while on the other hand there could be no question of the effectiveness of the spray when used under field conditions in spite of leaves, grass, and weeds at the base of the plant.

Since the period for spraying is very limited and reinfestation of sprayed plants is almost certain to occur in a short time, by far the most promising means of control seems to be a resistant strain of gooseberry which has been developed during this work. The first assumption would naturally be that it must be a different variety of gooseberry but different horticulturists who have examined both fruit and foliage of these plants have been unable to distinguish or separate them from the typical houghton gooseberry. It may be possible that it will later be considered a varietal form but it apparently is not at the present time. The fruit is practically the same in appearance and flavor. A few of these plants were first discovered in a commerical planting and were kept under close observation. The question of variety was next considered, the source of the material was traced, and horticulturists were asked to examine fruit and foliage. The plants were then propagated in the field and several plants were used for further testing. Aphids transferred to these plants attempted to feed and under the binocular microscope were observed to insert their beaks into the plant and remain for several minutes as though they were feeding. No galls were formed on these plants as a result and the aphids in every case would wander away and leave the plant in the course of a few hours time. The factor of resistance whether it be chemical, a thickened cuticle, or some other condition is not known and has not been investigated by the writers since the chief object was to develop first a field control.

These resistant plants as observed in the field have made more rapid growth, have produced much greater crops of fruit, and have been more vigorous in every way. The leafing in the spring was just slightly in advance of the infested plants and this is shown clearly by the accompanying photographs. This plant is not only promising as a control but furnishes a permanent condition so that the annual means of combat will not be necessary. A preventative measure of this kind will save certain growers severe losses which have been sustained during the past few years. One grower who has been following this work very closely and has been interested in the outcome of this problem has, following the

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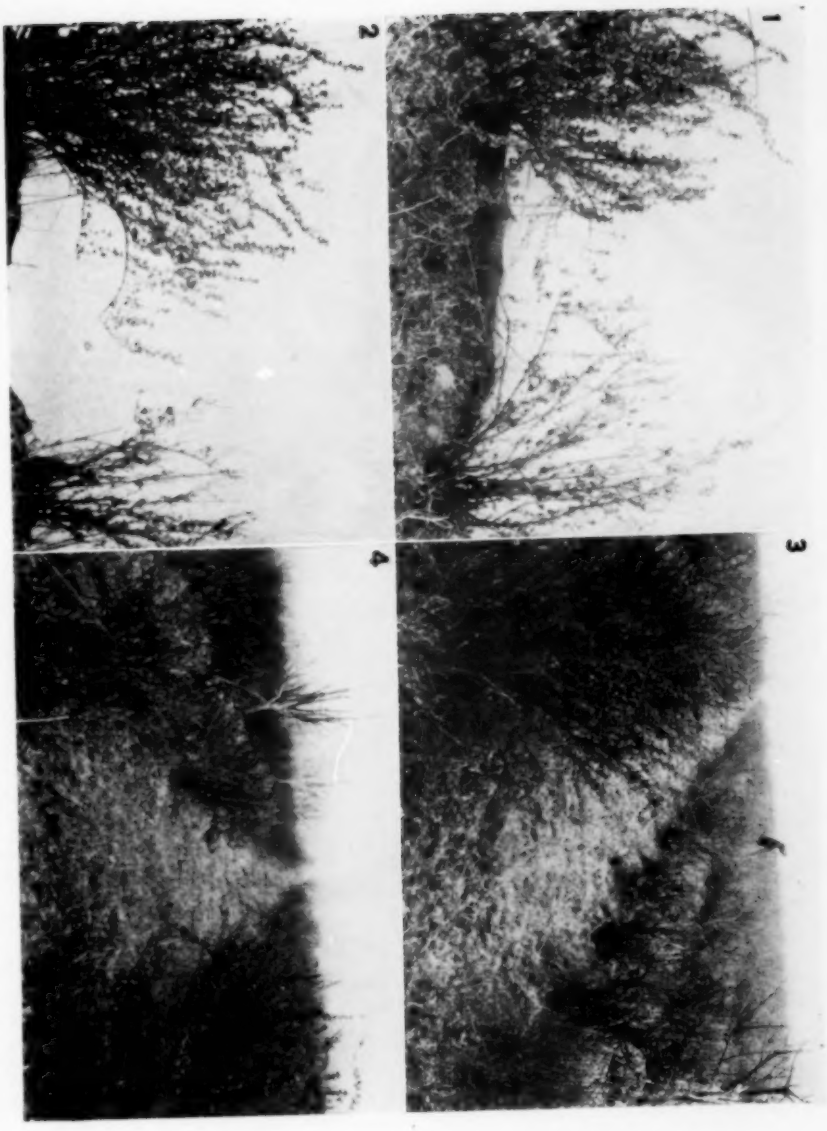
EXPLANATION OF PLATE I

1 and 2. Resistant plant at left; plant at right showing many galls.
3. Showing difference in size and growth in field. Resistant plants at left, susceptible in foreground at right.
4. Same as 3, resistant plants at right, susceptible at left.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suggestions of the writers, already replanted with these resistant plants a two-acre field, previously heavily infested.

Several natural enemies have been reared from these aphids or found feeding upon them. A common species of syrphid fly which has not been identified is frequently found inside the galls. Five species of parasites have been reared namely *Aphelinus sanborniae* Gahan, *Lysiphlebus testaciipes* (Cress), *Pachyneuron siphonophorae* (Ashm), *Asaphes americanus* Gir., and a species of *Charips*. None of these have given any marked degree of control.

MR. RAYMOND OSBURN: I just want to raise one question as to whether resistance is complete.

MR. D. M. DELONG: In answering that I would say that some plants seemed to show a partial resistance, but the plants we have observed over a period of three years have not shown a gall.

SECOND VICE-PRESIDENT LEROY CHILDS: The next paper is by B. A. Porter.

THE TARNISHED PLANT BUG[1] AS A PEACH FRUIT PEST

By B. A. PORTER, *Associate Entomologist, U. S. Bureau of Entomology, Vincennes, Ind.*

ABSTRACT

Injury by the tarnished plant bug, *Lygus pratensis* (L.) to peach blossoms and to very small peaches during the few weeks following blooming time in southern Indiana is here described. The injury is of a type very unusual to be caused by a sucking insect, but repeated caging tests have demonstrated that the tarnished plant bug is responsible. It seems very likely that this is the injury which later in the season develops into a scarred and distorted condition, which has locally been given the name "cat-faced" peaches, but the proof is not complete. This "cat-facing" causes serious losses in southern Indiana, southern Illinois, and western Kentucky.

The tarnished plant bug has been accused of a long list of crimes, among which may be mentioned deforming and stunting peach nursery stock, being generally injurious to many garden and truck crops and ornamental plants, as well as being an active agent in the transmission of a number of plant diseases. From time to time it has also been reported as injuring the blossom buds and newly set fruits of a number of orchard trees, occasionally including peach. The writer here renews the accusations against this chronic offender, this time as injuring peach blossoms and small peaches during the few weeks following the blooming period.

[1] *Lygus pratensis* (L.)

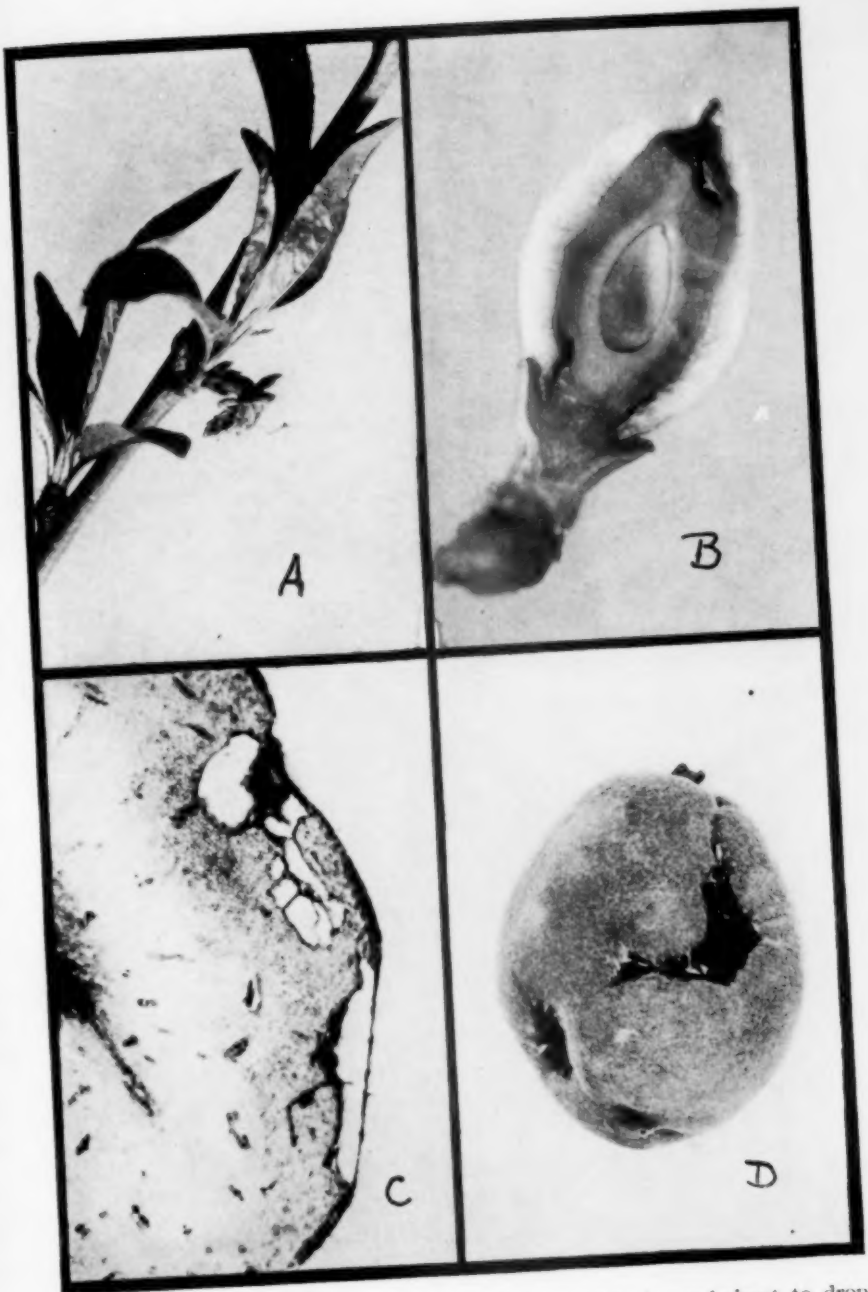
Detailed evidence has been gathered as to the type of injury and the responsibility of this species therefor.

The bugs concerned in this particular problem are those which have hibernated as adults, and which emerge from winter quarters with the first warm days of spring. (In some instances the species may pass the winter in other stages, but those individuals do not concern us here.) Many of the adults which happen to have wintered in or close to a peach orchard are attracted to the opening peach blossoms, which offer them a very succulent and attractive food. As early as April 1, close examination in the orchards in southern Indiana will reveal considerable numbers of the bugs around the swelling blossom buds. It is very likely that many of these buds are prevented from opening by the feeding punctures of the bugs.

During the blooming period and as the petals drop, the feeding continues. At this stage the writer has observed many blossoms and newly set peaches withering and dropping. Such injury has been repeatedly produced in cages in which tarnished plant bugs have been present, and no such injury has occurred in cages from which the bugs have been excluded. Plate I, *a*, shows a peach bloom injured in this manner. On removing the shuck from the bloom, the pistil will be seen to have at the base a sunken and blackened area. The nature of this lesion will be discussed presently.

As the young peaches start growing after pollination, the bugs continue to feed on them, causing an injury very unusual to have been caused by a sucking insect. The peach fuzz is usually undisturbed, although the point of attack may be marked by a stain. On removing the fuzz, and the skin if necessary, an irregular cavity is found. This cavity is sometimes rather deep, but more often is comparatively shallow, and almost always extends in several directions for a considerable distance underneath the fuzz or skin. With very small peaches the skin is usually broken down along with the underlying tissue; with older peaches the skin remains intact except for a central puncture where the insect's beak was inserted. A longitudinal section of an injured peach is shown in Plate I, *b*. For the photomicrograph of a cross section of an injured peach, shown in Plate I, *c*, the writer is indebted to Dr. J. B. Kendrick and Dr. W. M. Gardner, of the Purdue Agricultural Experiment Station. The first named prepared the sections, and both had a part in preparing the photomicrographs used for illustrations and lantern slides.

The fact that the tarnished plant bug is responsible for this injury has



A, peach bloom injured by the tarnished plant bug, withering and about to drop, x about 2/3; *B*, longitudinal section of a peach injured by the tarnished plant bug, x 5; *C*, photomicrograph of a cross section of a peach injured by the tarnished plant bug, x 25; *D*, "cat-faced" peach, x about 2/3.

been proved in a long series of caging tests, in which nine peaches out of every ten exposed to the bugs were severely injured, and in which nothing of the kind occurred in the check cages. During the few weeks immediately following petal fall this injury is very common in the peach orchards of southern Indiana and Illinois, sometimes affecting 25 per cent or more of the peaches, and is the predominant type of injury during this period. Severely damaged peaches drop off, causing considerable losses in years of short crops.

It has been pointed out a number of times in connection with the tarnished plant bug as a pest of other hosts, that the injury resulting from its attacks is much greater than could be caused by the mere mechanical insertion of the mouth parts and the extraction of the plant juices. The general belief is that some toxic material is injected during the feeding process, which causes in many cases a distortion and malformation. A well-known example of this effect is the so-called stop-back, or bush-head of peach nursery stock. Smith (2)[2] has made careful studies of the injury produced by another Mirid (*Plesiocoris rugicollis* Fallen) which, like the tarnished plant bug, produces injuries and distortions all out of proportion to the amount of feeding which is done. He observed that the secretion injected as feeding took place brought about a progressive breaking down of tissue until the oozing of sap from the injured cells diluted the poison to a point where no further injury took place. Something similar seems to occur when the tarnished plant bug feeds on a young peach, the tissue of which in the very early stages of development seems to be very readily broken down by this toxic material, resulting in the irregular lesions just described.

There seems to be in the literature very little information dealing with tarnished plant bug injury to peach fruits. Lowe (1) reported in 1900 a case of tarnished plant bug injury to peaches in New York. In this instance the peaches attacked were in a slightly more advanced stage—possibly an inch or more in diameter. Lowe stated that drops of gum oozed out at the points where injury occurred, a condition which the writer has not observed in the small peaches with which this paper deals. The small amount of sap which flows is usually not more than enough to stain the fuzz around the puncture. More mature peaches, however, have been occasionally observed with gum oozing out of tarnished plant bug punctures.

In experimental cages, the peaches injured by tarnished plant bugs dropped within a short period after being fed upon by the bugs, prob-

[2]Numbers in parentheses refer to the references listed at close of paper.

ably because the injury was more severe than usually occurs in the field. Evidence is therefore lacking as to the final form assumed by peaches thus affected. From the nature of the injury, however, it seems very likely that the lesions produced by the tarnished plant bug cause the greater part of the deformed condition so prevalent in peaches at harvest time in southern Indiana, southern Illinois, and western Kentucky. Peaches thus affected show varying numbers of corky areas, which are smooth and devoid of fuzz, except for occasional islands of dried up remnants of skin and fuzz, which have evidently clung to the scar after the rest of the skin has sloughed off. These areas are irregular in shape, and vary in size, some being very small, while others may be a half square inch or more in extent. The portion of the peach surrounding these areas is usually irregularly distorted, and severely injured peaches are usually stunted. Locally this condition has been termed "cat-facing." A "cat-faced" peach is illustrated in Plate 2, 1, *d*, a photograph for which the writer is indebted to Professor J. J. Davis.

In his report of injury to peaches by the tarnished plant bug, Lowe stated that the skin over the injured areas withered, and the fruits became more or less deformed. This injury was probably identical with the "cat-facing" here described.

In orchards adjacent to woodlands in Ontario (3) and New York (4) a somewhat similar injury to peaches has been caused in recent years by several other species of *Lygus*—*Lygus caryae* Knight, *Lygus quercalbae* Knight, and *Lygus omnivagus* Knight. These species breed on hickory, oak, and other forest trees, and in early summer when mature, have been observed migrating into nearby peach orchards and feeding on the partially developed peaches. Fruits injured by these species of bugs are not so much distorted, and the scarred lesions are not so large as is the case with the "cat-faced" peaches of the Middle West, probably because the peaches are in a more advanced stage of development when attacked by the woodland species of bugs. These species pass the winter in the egg stage on their forest tree hosts, and therefore must pass through the nymphal stages and reach maturity before migrating into the peach orchards. On the other hand, the injury occurring in Indiana and Illinois is caused by hibernating adults (assuming that the tarnished plant bug is the species responsible), and the feeding is done while the peaches are very small, and more subject to distortion when injured.

This "cat-facing" problem is a serious one in the region where it occurs. In one orchard in western Kentucky, two-thirds of the peaches

by actual count at harvest time were seriously distorted, and most of them were very much stunted. In addition to this, there must have been a serious loss from dropping early in the season. Mr. W. P. Flint, of the Illinois State Natural History Survey, writes that actual counts made by Mr. S. C. Chandler in a number of southern Illinois orchards in 1925 showed a general average of 14 per cent of the fruit "cat-faced," with extreme cases of 38 and 45 per cent of injury.

As to control, the writer is not in position to do more than to state the problem and point out a few of the difficulties involved. The solution of the problem would appear to lie in one of two possible directions: either prevent the bugs from feeding on the peaches during the short, but critical period immediately following the opening of the blossoms, this by means of contact materials or repellents; or prevent the breeding of the bugs in or close to the orchards. Breeding does not occur to any extent on peach, but does occur freely on various species of weeds and other plants. Clean culture will probably have some value, especially if it can be extended to include the fields adjacent to the orchard to be protected. Cultivation, however, cannot be depended upon for complete control, since severe injury has been observed in orchards which have been kept almost entirely free of weeds. It seems possible that the bugs may migrate considerable distances in the late fall before entering winter quarters, and may cover additional ground after leaving hibernation in the spring. A further difficulty lies in the fact that cultivation does not affect the crop produced during the season when it is practiced, but affects the next season's crop by the reduction effected in the bug population in the orchard. In years of crop failure on account of freezes, excessive cultivation in a peach orchard is frequently undesirable. Contact materials have never given satisfactory control of this active and resistant bug.

References

(1) 1900—Lowe, V. H. Miscellaneous notes on injurious insects. New York Agricultural Experiment Station (Geneva) Bull. 180, p. 135.

(2) 1920—Smith, K. M. Investigations of the nature and cause of the damage to plant tissue resulting from the feeding of Capsid bugs. *In* Annals of Applied Biology, Vol. 7, p. 40–55.

(3) 1922—Ross, W. A. Insects of the season in Ontario. *In* Rep't. Ent. Soc. Ontario for 1921, p. 42–50.

(4) 1923—Thatcher, R. W. Peach-deforming Capsids. *In* New York Agricultural Experiment Station (Geneva) Annual Report for 1922, p. 39.

Mr. R. C. Smith: We have been studying this pest as an alfalfa insect at Manhattan and we have been having very great difficulty rearing it,

keeping it alive in cages. I should like to ask Mr. Porter if he has developed a rearing technique in which they are able to keep these alive.

MR. B. A. PORTER: Fortunately, technique, as far as I have gone, has not been necessary, because the injury is produced by the hibernating adults, and all you have to do is to wave your net around two or three times and you get the hibernating adults. I haven't paid any attention to that.

MR. E. N. CORY: I should like to say we had a similar injury to this in Maryland orchards. We submitted it to Professor Pettit in Michigan, who found it was exactly similar to the injury he had identified as coming from a species of thrips a number of years ago.

MR. B. A. PORTER: In the cage work which I have carried on, thrips have been present in all cases, but I have never had any injury until I introduced some other insect. In about seven or eight cages I have added as many as twenty-five thrips to the peach, placed them directly on the peach, and never got any sign of injury until I put some other insect in there.

MR. W. P. FLINT: This injury was called thrips injury and was so classified. It was identified as thrips injury in Illinios more than forty years ago: that is, thrips was supposed to be the insect causing the trouble, but I think that Mr. Porter's work and the work by Mr. Chandler of southern Illinois have almost eliminated the thrips. Mr. Chandler found that the abundance of thrips in different orchards apparently had no correlation with the abundance of this so-called "cat-face" injury.

MR. W. S. REGAN: I might say that in the state of Washington there are a number of cases of injury by the Tarnished plant bug just previous to the picking time. There was no outward evidence of the injury when the fruit was picked. It was noticed they broke down very rapidly, and by taking off a bit of the skin, you could see just underneath the skin there was a spongy condition. That condition has been attracting considerable attention. It seems to me that the bugs will come out of the alfalfa, where the fruit hangs low, and get on the fruit in large numbers. I have seen perhaps as many as twenty-five bugs on a single fruit. It seems to be localized rather than general.

MISS EUGENIA MCDANIEL: I should like to say that the work as shown by Mr. Porter differs considerably from what we had in Michigan. In Michigan our little thrips just work under the fuzz of the peach and don't go into the meat at all.

SECOND VICE-PRESIDENT LEROY CHILDS: The next is a paper by W. P. Flint and J. H. Bigger.

CONTROL OF THE FRUIT TREE LEAF ROLLER WITH LUBRICATING OIL EMULSION

By W. P. FLINT and J. H. BIGGER, *Natural History Survey, Urbana, Ill.*

ABSTRACT

From 1922 to 1924, the Fruit Tree Leaf Roller, *Archips argyrospila*, increased in abundance in the western Illinois orchards, and for the first time became a serious pest of apples in this section. In 1924, this insect destroyed up to 50% of the entire crop in some of the largest orchards. During the winter of 1924–25, experimental work was carried on to test the effect of different oils and oil emulsions on the eggs of this insect. The result of these experiments showed a very high kill of eggs by the use of 8% boiled lubricating oil emulsion, and by some of the commercial oils. Some of the largest orchards were sprayed with this strength of oil emulsion during the dormant period, and a nearly complete clean-up of leaf roller obtained. The damage was reduced in 1925 to a point where only 2% or less of the apples showed feeding by the leaf roller larvae. The eggs of the leaf roller were fully as abundant in these orchards in the winter of 1924–25, as was the case in the winter of 1923–24. Data on the hatch of eggs from untreated check plots showed a very high per cent of hatch. No bad effects from spraying with the percentage of lubricating oil emulsion was noted during the summer of 1925, and trees thus sprayed bore heavy crops of fruit during this season.

The Fruit Tree Leaf Roller has usually been considered of little importance in Illinois. About 1922, the insect began to increase in numbers in apple orchards in the western part of Illinois, and during 1923, caused quite serious damage in some of these orchards. In 1924, it became so numerous as to cause the loss of at least 50% of the crop in some of the larger apple orchards in the western part of the State.

During the dormant period of 1924–25, a series of experiments were carried on in an attempt to develop methods of controlling this insect under Illinois conditions. The summer's work of the previous year had shown, as had already been demonstrated in the western states that it is very difficult to control this species by the application of the poison sprays. The experiments were therefore limited to applications of oil sprays during the dormant period of the apple tree in an attempt to control the insect in the egg stage. This work followed very closely the methods which have been found successful in the western states. Several different grades of lubricating oil emulsion were applied at 4 and 8% strengths. These were made as cold mixed emulsions using calcium caseinate, glue, or Bordeaux as the emulsifying agent. The miscible oil recommended by Melander in Washington, was tested in the course of this work, as well as several commercial miscible oils, and boiled oil emulsions. Paraffin base oils of 90 and 200 viscosity were used. A comparison was made between the light and the heavy oils emulsified with the same emulsifying agent.

TABLE I.

Treatment	Number of tests	Number of egg masses under observation	Per cent of egg masses from which larvae hatched	Total number of larvae hatched	Average number of larvae per egg mass
No. 1. Cold mixed calcium caseinate oil emulsion. Oil 90 viscosity, used at 4% strength	4	75	12	167	2.2
No. 2. Same as No. 1, used at 8% strength	4	73	1.2	20	0.2
No. 3. Cold mixed calcium caseinate oil emulsion. Oil of 200 viscosity, used at 4% strength	4	77	0	—	—
No. 4. Same as No. 3, used at 8% strength	4	63	0	—	—
No. 5. Melander's formula, using homemade miscible oil (lubricating oil 200 viscosity 91% emulsifier, 9%) (Emulsified Cresol 45%, potash fish oil soap 55%), used at 4% strength	3	77	52	1378	18
No. 6. Same as No. 5, used at 8% strength	3	70	49	1681	24
No. 7. Glue emulsion made according to Melander's formula (50 gallons of oil of 200 viscosity, 16½ gallons of water, and 2 pounds glue) used at 4% strength	3	68	2.9	128	1.8
No. 8. Same as No. 7, used at 8% strength	3	70	0	0	0
No. 9. Boiled lubricating oil emulsion made by Illinois formula (1 gallon oil, 2 pounds potash fish oil soap, ¼ gallon water). Oil 90 viscosity, 4% strength	4	68	24.4	237	3.4
No. 10. Same as No. 9, used at 8% strength	4	61	8.1	14	0.2
No. 11. Boiled lubricating oil emulsion made by Illinois formula (1 gallon oil, 2 pounds potash fish oil soap, ¼ gallon water). Oil of 200 viscosity, 4% strength	4	65	28.6	625	9.6
No. 12. Same as No. 11, used at 8% strength	4	66	1.5	7	0.1
No. 13. Cold mixed Bordeaux oil emulsion using 4–6–50 Bordeaux hydrated lime diluted with ½–½–50 Bordeaux, used at 4% strength. Oil of 200 viscosity	4	72	38.8	1502	20.8
No. 14. Same as No. 13, used at 8% strength	4	73	0	—	—
No. 15. Sherwin-Williams "Free-mulsion," 1 to 24	3	36	52.7	340	9.4
No. 16. Same as No. 15, used at 1 to 12½	3	35	40	235	6.7
No. 17. "Sunoco" oil emulsion, used at 1 to 24	3	70	50	933	13.3
No. 18. Same as No. 17, but used at 1 to 12½ parts water	3	64	32.6	518	8
No. 19. Standard Oil No. 3290 emulsion, used at 1 to 24 parts of water	4	69	43.5	1059	15.3
No. 20. Same as No. 19, used at 1 part to 12½ parts water	4	61	29.5	520	8.3
No. 21. Untreated check	4	85	71.7	1986	23.2
No. 22. Same as No. 21	4	63	65	1597	24.5

The result of this work shown in the preceding table, indicated that 8% lubricating oil emulsions, emulsified with calcium caseinate, glue, or Bordeaux mixture as a cold mixed emulsion, or with potash fish oil soap as a boiled soap emulsion, are very effective in preventing the hatch of leaf roller eggs which are thoroly wet with such sprays.

Some 1200 acres of apple orchards in western Illinois were sprayed with 8% boiled, potash fish oil soap, lubricating oil emulsion, during the winter of 1924–25. In this work, the oils used were paraffin base, and of about 90 viscosity on the Saybolt test. The following table shows the control obtained in an orchard treated by the owner with such an emulsion. In this orchard, more than 50% of the fruit was damaged by leaf rollers in the growing season of 1924, while in the same orchard in 1925, less than 2% of the fruit was injured. The egg masses of the leaf roller were fully as abundant in the orchard during the winter of 1924–25, as was the case in the winter of 1923–24. Egg masses taken from the trees before spraying, and hatched in the greenhouse, yielded a sufficient number of leaf roller larvae to make it seem certain that if the leaf roller had not been controlled, the orchard would have been as badly damaged during the growing season of 1925, as had been the case during 1924.

TABLE II.

Treatment	Number of egg masses under observation	Number of egg masses from which larvae hatched	Total larvae hatched
Spraying by the orchard owner with 8% boiled lubricating oil emulsion, oil of 90 viscosity	85[1]	4	87[2]
Untreated check	48		935

[1]These egg masses were taken at random, two or three from a tree in different parts of the orchard.
[2]Seventy-nine of these larvae hatched from a single egg mass which had apparently not been hit by the spray.

Similar results in the control of the leaf roller have been obtained in the western states, as shown particularly by work recently reported in Idaho[3] by Mr. Claude Wakeland where much the same type of oil emulsions were used.

There are a few rather significant things in regard to the work in Illinois which seem worth special mention. In the largest orchard treated, spraying was started on December 8, 1924, and sprays were applied every day for the next eight or ten days, over 100 acres of 24 year old apple trees having been sprayed during this period. On December 19th, the temperature dropped to —3° F., and was below zero nearly every night until the 28th, when the temperature was —20° F. It was

[3]Idaho Agr. Exp. Sta. Bul. No. 137.

feared that this drop in temperature would cause injury to the apple trees recently sprayed with an 8% to 9% oil emulsion. However, no injury whatsoever developed on these trees. This entire orchard consisting of some 800 acres was sprayed when the weather permitted, between December 8th and April 2nd. The 8% to 9% emulsion was applied very thoroly to the trees in an attempt to cover all of the small twigs and branches where leaf roller eggs were most abundant. No ill effects of this heavy application of oil was seen in the orchard during the growing season of 1925. The trees bore the largest crop in the history of the orchard, the foliage was good and of a normal color, and no blistering of the bark or dying back of the twigs could be found in any part of the orchard. Special care was taken that all lots of oil emulsion applied to the trees were in a good condition, if free oil separated out in the spray tank, the lot was discarded.

None of the other orchards sprayed with a well made lubricating oil emulsion at 8 to 9% oil were injured by these applications. Judging from the results of the past season only, it is safe to use such emulsions on mature apple trees under the conditions found in the upper Mississippi Valley. Several seasons work will be necessary before this can be definitely determined.

MR. PARKER: I should like to ask the speaker if he got the same control with 4% emulsion.

MR. W. P. FLINT: We got somewhere around 80 to 90% control with 4% emulsion. There are one or two of those emulsions on which we did a little better than that.

MR. PARKER: That corresponds almost exactly with our work in Montana. We got control averaging from 90 to 100%.

MR. W. P. FLINT: That coincides almost exactly with what Mr. Wakeland just recently published in an Idaho publication.

MR. J. A. HYSLOP: I should like to ask Mr. Flint if I understood him right in saying that all his checks were taken either before that heavy freezing weather or some taken afterwards.

MR. W. P. FLINT: We took three series of checks, one about the first part of December before the freezing weather; another a few weeks after, about the first of January, and another about the first of March.

SECOND VICE-PRESIDENT LEROY CHILDS: The next paper is by Leonard Haseman.

CODLING MOTH INVESTIGATIONS

By LEONARD HASEMAN, *Columbia, Mo.*

ABSTRACT

Results, which have been secured since 1922 on the investigation of the codling moth, *Carpocapsa pomonella*, to determine what type of nozzle and what pressure places the greatest amount of arsenic in the lower calyx cup of apple blossoms, are given in this paper. These data show that a fine mist spray under 100 pounds pressure places the most arsenic in the calyx cup, though not a great deal more than in the case of coarser sprays with higher pressures. The average amount placed in the calyx cup in thorough orchard spraying work is sufficient to prove a lethal dosage for the small apple worms which attempt to enter at the calyx end of the fruit.

At this time I merely wish to present some additional data on our codling moth investigations, about which, I spoke at the Boston meeting of this society in 1922. As an introduction to what I wish to present at this time I shall read the abstract of my earlier paper.

"The original purpose of this investigation was to determine what type of spray nozzle and what pressure places the greatest quantity of arsenic in the lower calyx cup of apple blossoms for the control of the codling moth, *Carpocapsa pomonella*. The spray tests are made immediately following the dropping of the petals by using usually three nozzles each with three pressures. To determine the calyx content of arsenic a counted number of the small apples are collected from each of the test trees and the lower calyx cups with their arsenical content are carefully removed for chemical analysis. In this way it has been possible to determine the average arsenical content of the calyx cup of each apple from trees treated with different pressures and nozzles. These experiments show that a high pressure and coarse nozzle is less effective than a lower pressure with a nozzle throwing a finer mist. They also show that where the average calyx content of arsenic is the highest, the percentage of calyx worms in picked apples is not always the lowest.

After determining the average quantity of arsenic placed in the calyx cups under good orchard management, the investigation was enlarged in order to determine whether or not this quantity of arsenic is sufficient to poison apple worms attempting to enter at the calyx end of the fruit. This called for careful laboratory tests to determine the lethal dosage for apple worms. Doses of powdered arsenate of lead varying from one millionth to five ten thousandths of a gram were fed to apple worms of varying stages of development. To administer these small doses one or more drops of distilled water with the dose in suspension were placed on bits of apple which the worms consumed. These experiments show that for third instar apple worms and older

ones, the lethal dosage is approximately five ten thousandths (.0005) of a gram of powdered arsenate of lead. This is practically the same as the average calyx cup content (.000521 grams) as shown from numerous orchard spray tests. It seems certain therefore that in good orchard spraying the lower calyx cup of each blossom hit squarely with the "Calyx Spray" will receive sufficient arsenic to poison the small apple worms which may attempt to enter the fruit at that point."

Since 1922 the same line of investigation has been continued so far as the determination of calyx content is concerned. No additional tests on lethal dosage for the apple worm have been made. It should be said that from year to year, there are considerable variations in the quantity of arsenic in the inner calyx cup as shown by the chemical analyses. In these arsenical determinations the titration method has been used and the test for such small quantities is necessarily a delicate one. So far as possible we try to have the same chemist make these tests from year to year. All the tests for the past three years were made by Neely Turner who at the time was an instructor in the Entomology Department.

The following table gives the average arsenous oxide content of each Calyx when the last three years tests are combined.

AVERAGE ARSENOUS OXIDE CONTENT OF EACH CALYX IN THREE YEARS

Pressure	Nozzle	AS_2O_3 per calyx	Amounts reported in earlier paper
250	gun	.0001532	.0001184
250	Bordeaux	.0001642	.0001850
250	disc	.0001668	.0001267
175	gun	.000160	.0001970
175	Bordeaux	.0001400	.0001048
175	disc	.0001209	.0001346
100	gun	.000047	.0000578
100	Bordeaux	.0001338	.0001332
100	disc	.0001767	.0002805
	Lethal dosage	.0001428	

It is of interest to note that the greatest amount is found where the disc nozzle with 100 pounds is used. However, almost as good results are secured where the high pressure is used with each of the three types of nozzles. As in my earlier report the minimum is placed in the calyx by the spray gun with the low pressure, as should be expected. The intermediate pressure with the three nozzles gives results intermediate between the best and the poorest.

The one disconcerting thing about these experiments is the fact that we continue to fail to get a definite correlation between the amount of

arsenic placed in the calyx cups and the protection from worms entering at the calyx end of the fruit. The next paper on the program by Mr. Smith will, I hope throw some light on this.

MR. E. D. BALL: Mr. Chairman, the paper seems to carry the inference that if you fill the calyx cup with poison sufficient for a lethal dose for one worm, you have protected that apple. That inference may be good in Missouri, but not out in the West. I have counted as high as six "dead heads" in the calyx cup of one apple; a black head is all that is left of a codling that goes into the calyx and gets poisoned. A satisfactory method in the Western country would require many times a lethal dose.

MR. W. P. FLINT: I gave the maximum dosage for the larger worms, assuming there would be many large worms get in, and if the lethal dosage would kill the large worms, it would be likely to kill the smaller ones, too. I know in non-sprayed tests in this section of the country ordinarily you won't find as many worms going into an apple as you probably do in the West. It isn't often you get more than one worm that enters through the calyx of the same apple.

MR. E. D. BALL: The rest go through somewhere else, but if you kill the worm, you may continue to get worms going in there the rest of the season.

MR. G. M. LIST: I might tell one just a little larger than that related by Dr. Ball. We find in Colorado that practically all of our "stings" are due to the worm being killed after it has gone into the fruit. We have quite commonly found 50 or 60 "stings" in one apple. The record, as I remember it, was 63.

MR. E. D. BALL: Gentlemen, I want to say that this 42 count was in Colorado.

SECOND VICE-PRESIDENT LEROY CHILDS: The next paper is by R. H. Smith.

THE EFFICACY OF LEAD ARSENATE IN PROTECTING APPLES AGAINST CODLING MOTH INJURY

By R. H. SMITH, *Stanford University, Calif.*

(Withdrawn for publication elsewhere).

MR. E. D. BALL: I don't want to discuss the paper, but I want to state that it is the most informative paper that I have heard on the

codling moth in many years. There is a wealth of material there that will help us to interpret our failures.

MR. P. A. GLENN: There is a difference between the amount of arsenate of lead that is necessary to put in the calyx and on the outside of the apple in order to be effective. I don't know that I have ever heard an explanation for that. I have noticed, however, that when a larva goes through the side of the apple, it does not eat its way through; it merely gouges out the epidermis and lays it aside, it does not eat the epidermis, and I think that the poisoning of the larva is not from the poison that is on the outside of the apple but from the poison that it carries into the apple on its feet and eats after it gets in there. As the larva enters the calyx of the apple, it does not go in directly; you can find a larva in the calyx of the apple two or three days after it has entered, showing it has entered from the surface instead of the calyx, but it goes in, lays aside the pieces of epidermis that it bites off, and is very likely poisoned inside, if it is poisoned at all, by poison that it carries in there on its feet.

SECOND VICE-PRESIDENT LEROY CHILDS: The next paper is by Mr. K. C. Sullivan.

THE USE OF DUSTS FOR THE CONTROL OF APPLE PESTS AND DISEASES UNDER MISSOURI CONDITIONS

By K. C. SULLIVAN, *Columbia, Mo.*

ABSTRACT

During the season of 1925 the dust sprays were tried out for the first time for the control of apple pests and diseases with very good success. Both sulphur dust and the copper lime dust compared very favorably with the liquid sprays while in some cases they gave better control on both the insect pests and plant diseases than did the liquids. It is quite probable that it could be possible to use them as a supplement to liquid sprays for the control of insect pests and diseases.

About fifteen years ago a number of Missouri orchardists became interested in dusts for the control of apple pests and diseases. A number purchased dusting machines and for a few years religiously applied the dusts. The results obtained at that time were variable. Some seasons the dusts gave, it seemed, just as good results as the liquid sprays, while in other seasons they proved to be almost complete failures as compared with the liquid sprays. In other words, the dusts could not be relied upon year after year to give uniform results and within a short time they were discarded.

There are a number of reasons why dusting appeals to the Missouri fruit grower. In the first place, most of the big commercial orchards in Missouri are found along the Missouri River hills and in the Ozark section. Much of the land is more or less rough and hilly with the re-

sult that a dusting machine is much more easily handled than a liquid spraying machine. At the present time there is much good orchard land, especially along the Missouri River hills, that would be utilized if it were possible to use a liquid spraying machine, but due to the steep slopes, it is unsafe to use such a machine on it. A dusting machine can, however, be used on much of this steep land without great inconvenience.

In the second place the duster eliminates the water problem which is at times quite a problem in many commercial orchards and it also eliminates the somewhat disagreeable task of mixing liquid sprays.

In the third place, a dust spray can be applied much more quickly than a liquid. Due to weather conditions and other factors, it is oftimes very important to get a spray on in a limited time. This is more easily accomplished with a dust than with a liquid. This also materially affects the labor problem.

In the fourth place the writer believes that a more thorough job of covering the foliage and fruit can be accomplished with labor which is less skilled than can be accomplished with a liquid machine. Most every one realizes the importance of thorough spraying and those who have had much experience realize how hard it is to obtain help that can properly manipulate a spray rod or a spray gun.

Recently, there has been a revival of the interests in the dust sprays. This revival of interest is probably due to a number of factors. Considerable progress has been made in perfecting efficient dusting chemicals. Dusting chemicals which are available now are undoubtedly better than those which were used a few years ago. Also improvements have been made in dusting machines and last but not least it seems that insect pests and diseases are becoming more serious year by year with the result that in order to produce clean fruit it is necessary to keep continually on the job with a spraying machine. There was a time when the average Missouri orchardist applied three sprays during the season and he considered the application of these three sprays quite a task. At the present time many of our growers are applying eight sprays per season. The time it takes and the cost involved in applying so many liquid sprays has caused the growers to look for a more economical method of checking the ravages of insects and diseases. Naturally the first possibility to suggest itself has been the dust sprays and the possibility of using the dusts as a substitute for the liquids or just as a supplement.

In the spring of 1925 a series of tests were inaugurated in Central Missouri using the dusts and it is planned to continue the work over a

sufficiently long period to definitely establish the value of the dusts under Missouri conditions. Also the scope of the work will be greatly enlarged this coming season.

The work during the past season was carried on in a large commercial orchard. The trees used in the experiment were Ganos and about twenty-five years old. They were in a healthy vigorous condition, being admirably adopted for experimental work. The bloom on these trees was exceptionally heavy and the set of fruit on the Ganos was much heavier than on any other variety in the orchard. The block of Ganos was laid off in plots of ten trees each and the dusts were applied with a power machine. The regular sulfur and the copper-lime dusts were used. The sulfur dusts were used at strengths of 90 pounds of superfine dusting sulfur and ten pounds of arsenate of lead and 85 pounds of superfine dusting sulfur and fifteen pounds of arsenate of lead. The copper-lime dust was used at the strength of 80 pounds of hydrated lime, twelve pounds copper sulfate and eight pounds of calcium arsenate and at the rate of five and two pounds per tree. Also half of the plots received four applications of dust during the season while the other half received nine as is shown by the following schedule:

TABULATION OF MATERIALS AND APPLICATIONS

Plot No.	Material and strength	Lbs. per tree	No. applications	1st or cluster bud	2nd or calyx	3rd	4th	5th	6th	7th	8th	9th
1	90–10 sulfur	5	4	4/12	4/22		5/11				7/14	
2	"	2	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27
3	"	2	4	"	"		"				"	
4	"	5	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27
5	85–10 sulfur	5	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27
6	"	5	4	"	"		"				"	
7	"	2	4	"	"		"				"	
8	"	2	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27
9	80–12–8 copper-lime-lead	2	4	"	4/23		"				"	
10	"	5	4	"	"		"				"	
11	"	5	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27
12	"	2	9	"	"	4/30	"	5/15	6/1	6/15	"	7/27

A great deal of rain was experienced during the season. Rather hard showers of rain fell immediately following the third, fifth, sixth and seventh applications, and this undoubtedly had some effect upon the final results, but even so, at picking time in October quantities of dust was still visible on some of the fruit. Missouri orchardists are having

considerable trouble with the late summer broods of codling moth therefore the object of making nine applications of dust on half the plots was an effort to control the codling moth and also to make comparisons with the plots which were treated only four times.

The following table summarizes the results:

TABULATION OF RESULTS

Plot	Material and Strength	Lbs. per tree	No. applications	Cost of materials per acre	Efficiency for all insects and diseases	% curculio	Codling Moth: Calyx	Codling Moth: Side	Brown rot	Blotch	Scab
I.	90–10 sulfur-lead	5	4	$47.00	10th	36.0	0.5	15.3	6.1	0.3	0.4
II.	" "	2	9	42.30	1st	16.9	.3	8.8	2.5	.2	0
III.	" "	2	4	18.00	9th	20.1	1.1	19.7	4.9	1.9	0
IV.	" "	5	9	105.75	3rd	17.7	.2	11.4	4.9	1.0	.1
V.	85–15 sulfur-lead	5	9	124.90	2nd	22.5	.1	9.4	2.6	1.5	.3
VI.	" "	5	4	70.50	6th	21.8	.9	17.5	3.5	.4	.9
VII.	" "	2	4	22.20	7th	23.0	.7	15.1	3.2	.7	1.8
VIII.	" "	2	9	49.95	4th	24.9	.2	8.8	3.3	.4	1.5
IX.	80–12–8 Lime-copper-lead	2	4	12.15	13th	24.4	1.5	11.9	5.1	1.9	3.0
X.	" " "	5	4	30.40	11th	24.3	.6	12.0	3.8	7.3	1.2
XI.	" " "	5	9	68.40	5th	24.2	.2	10.1	4.4	1.1	.4
XII.	" " "	2	9	27.35	12th	24.6	1.0	12.7	5.2	1.1	1.7
XIII.	Check			13.00	8th	20.0	1.0	14.0	2.8	8.7	1.5

Liquid L. S. and Lead, 3 applications.

The results seem to indicate that on the whole two pounds of dust per tree will give practically as good control as five, also the cost of the chemicals when five pounds are used per tree is prohibitive. Even the cost of two pounds per tree is more than the liquid spray. Also, as was expected, nine applications gave better results than four, but there again the cost of making nine applications per season is great. On the whole the dust compared very favorably with the liquid and it is quite probable that it may be possible to use them as a supplement to the liquid sprays in controlling the pests and diseases with a saving of some time and money. This will be tried this coming season in two of the largest commercial orchards in Missouri and it is hoped that the results which are obtained will justify the use of the dusts. However, until tests extending over a period of years have been made can we definitely recommend the dust to take the place of the liquids or as a supplement to the liquid sprays.

SECOND VICE-PRESIDENT LEROY CHILDS: The next is a paper by E. W. Stafford.

THE COMPLEXITY FACTOR IN INSECTICIDAL MEASURES

By E. W. STAFFORD, *A. & M. College, Miss.*

ABSTRACT

An insecticidal measure, to be popular, must be simple. There should be few ingredients and few instructions. The farmer learns best and most from illustrations. Mixing and measuring should be done by the manufacturer. Commercial insecticides will be most satisfactory but should be regulated. Existing insecticide laws do not and can not regulate completely. Proven effective formulae should be in the Pharmacopoeia or otherwise standardized and commercial preparations made according to the same should receive endorsement of official entomologists. In certain cases insecticidal measures should be carried out by government employees.

FABLE: A man long ago recommended for a certain ailment a certain salt. Of these who suffered and heard him ninety per cent used the salt and were cured. Then he suggested that they dissolve the salt in water whereupon seventy-five per cent used the salt. He stated proportions, four and a half ounces of salt in nine and a third quarts of water and sixty per cent used it. He warned against any but china receptacles and forty-five per cent used it. He recommended that the water first be boiled and thirty per cent used it. When he said that the solution should be strained thru muslin fifteen per cent used it. He finally indicated distilled water for the solution and then nobody used it at all. Each modification had been sound and wise and he was much disappointed. Now he gave his solution a name and made it up himself and everybody used it.

MORAL: Everything else being equal, the number of persons who will adopt a recommendation varies inversely with the number of points of complexity in the recommendation.

The farmer is adverse to pondering on formulae, to weighing, measuring, testing, boiling, cooling, filtering, etc., He is a specialist.

The popularity of an insecticide depends upon three factors. These are its effectiveness, cost and simplicity.

The complexity of an insecticide does not depend merely upon the number of its ingredients but precautions, processes, proportions and specifications regarding ingredients count as points.

The necessity for repetition of a treatment is a weakness. This, especially if subsequent treatments differ from the initial one. Subsequent applications are apt to be omitted. Most satisfactory interims between treatments are even days, weeks or months. It is satisfactory to time them with some condition of plant or animal to which applied.

A choice of remedies is a weakness. One good remedy is more likely to be adopted than one of five.

Technical bulletins should not be sent to the farmer. They are a mutual courtesy between stations. Send him synopses of them full of pictures. Illustrate time to spray with pictures of bud, blossom and fruit. Picture life cycles in calendars showing where he lives each month of the year. Show distribution with maps. Chart the compatibility of sprays. Reproduce posters. Send him postal cards with big print and few words to tell him what he should do next Wednesday. This is all being done. It is a good thing. The farmer is tired when he reads.

In devising insecticides, effectiveness and cost of materials will always be major factors. Complexity will be major if left to the farmer and minor if taken over by somebody else.

Commercial insecticides can be a great help if made according to proper formulae. Sold reasonably, the slight addition in price will be obliterated by reduction in cost.

The large manufacturers are supplanting homemade mixtures with their standardized products. Most of their products are good. They make up in quantities experiment station formulae.

Among the small operators who sell secret preparations some are probably conscientious charlatans who think they have found the water of life, overlooked by science and some are not conscientious.

We have work for the local maker to do if he will.

I would recommend to the makers of insecticides as follows—

1. Have no secret preparations. Do not fear that the farmer will copy your product. He won't. If you will make up an effective material and label it for what it is we will endorse it. If not, not.

2. Put solids up in tablets or briquettes like loaves of sugar and graduate them for a twelve quart pail or for a fifty gallon barrel.

3. Put up liquids in bottles or cans which are graduated so the farmer can use the container as a measure.

Insecticide laws, state and federal, seem to standardize paris green and arsenate of lead and nothing else. Why not? In the case of other insecticides than the above, material must contain what the label says it contains, must not make extravagant claims and must not be harmful to animal nor plant to which to be applied. Any material, sold as an insecticide or not, bearing the inscription on the label U. S. P. must be made according to the United States Pharmacopoeia.

It might be a very good thing if we could collect the formulae of all our most practical and effective, tested and tried common insecticides and have them inserted in the national dispensary if this could be done. Then whoever cared to make them up according to specifications could

sell them under the U. S. P. inscription. The entomologists would inform the farmers of the significance of this mark and our analysts could help us to protect him.

About our simple insecticides nothing need be done. In regard to those which must be complex we must look for help to those who will make a vocation of preparing or applying standard and appropriate measures according to approved specifications. Also there may be a solution in community action and in the activity of corps of federal, state and civic employees in certain peculiar cases.

To the farmer—"if you want it done right, hire it done, and let us watch it done."

SECOND VICE-PRESIDENT LEROY CHILDS: The next paper is by Mr. V. I. Safro.

CYANIDES OF CALCIUM

By V. I. SAFRO, *Los Angeles, Calif.*

ABSTRACT

With the development of several commercial products, containing cyanides of calcium, differing in composition, greater accuracy in interpreting experimental results is now possible. "Calcium cyanide" as a generic term for all such products is not sufficiently accurate to avoid confusion.

The recent bibliography of insecticide literature includes a number of titles on calcium cyanide. With the increasing interest in and investigations of cyanide insecticides, it is to be expected that our information should become more accurate and that earlier errors in generalization be corrected or, at least, noted.

Chemical literature to date does not contain any description of chemically or commercially pure calcium cyanide in solid form. Nor has the writer been able to find in the literature to date that such product has ever been prepared. It is, therefore, quite natural that errors in generalization will be made until such time as the nature of calcium cyanide be chemically described.

Quite recently new and commercially pure cyanides of calcium have been developed. Descriptions of these compounds by Dr. F. J. Metzger and Dr. R. W. Poindexter, Jr., will shortly appear in the chemical journals.[1]

However, because of the number of investigations now under way by entomologists and the increasing difficulty in correcting earlier errors as

[1]F. J. Metzer, Industrial and Engineering Chemistry, Vol. 18, p. 161, Feb.,1926.

time goes on and in view of the fact that to date three quite different commercial preparations containing cyanides of calcium have been developed, it is considered highly advisable to call attention at this time to certain considerations that have suggested themselves as a result of the chemical work now in process of publication and based upon the results of field experiments conducted by the writer.

A very extensive and careful series of tests conducted by the writer in California in which detail records were kept on about one thousand citrus trees fumigated with several dust preparations containing cyanides of calcium, under many different conditions—including wet trees and wet tents—showed a very wide margin of safety to foliage and fruit in the use of commercially pure calcium cyanide. In mortality counts of several hundred thousand citrus red scales it was found that commercially pure calcium cyanide gave excellent control at dosages below the usually effective H C N concentrations. In test after test, full control of the scale has been obtained without the occurrence of foliage injury or fruit pitting usual under many of the conditions under which the tests were conducted.

The difference in results obtained in the field in tests with several commercial products containing cyanides of calcium emphasizes the the necessity of greater care in identifying and recording the specific cyanides used in experimental work and in drawing conclusions.

To date only one of these products has been described.[2] This product is made essentially by the fusion of cyanamid with ordinary salt (sodium chloride). It is now possible to make cyanides of calcium without the agency of salt and to make it commercially pure.

This, then, is the latest development to date that presents opportunity for increased accuracy in experimentation.

It is possible to determine to what extent results may be due to the cyanides of calcium themselves and to what extent they may be caused by other chemicals present in the commercial products or in their respective residues. Such chemicals may be inert as insecticides but may be active in their action on host plants.

Greater accuracy in interpretation of field tests can be obtained by comparing the effects of the several preparations—especially those containing sodium chloride or sodium cyanide with those products free of these compounds. In addition, field tests conducted by the writer indi-

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[2]U. S. Patent No. 1,359,257, Nov. 16, 1920, W. S. Landis.

cate the extreme advisability of checking all experiments concerned with plant injury by comparison with similar applications of the residue alone of each product.

The question of host plant injury is, of course, a very important one and extreme care should be taken by investigators in the interpretation of their results. Plant injury caused by products containing cyanides may, under various conditions, be caused by the evolved hydrocyanic acid gas itself, by the unevolved cyanides still present after the application has been made, by compounds occurring in the product as inert ingredients and by compounds occurring in the residue. The latter type of injury may be direct or a result of cumulative action of the residue in the soil.

With the development of several commercial products containing cyanides of calcium, each differing from the others in method of manufacture, in composition, in properties and particularly in the composition of the residue it is essential that the ingredient causing plant injury be determined with each product used.

In recording experiments, the product used should be specifically described. "Calcium cyanide" as a generic term for all such products is no longer an adequate description. As chemical investigations proceed, accurate descriptions will become available. For the present, perhaps, the distinction can be made on the basis of the nature of the inert ingredients, particularly whether they contain sodium compounds or otherwise. A distinction can also be made in the nature of the residue—whether containing sodium chloride or otherwise.

Some such distinction in description is absolutely essential in order to avoid the later confusion that will certainly otherwise result.

MR. R. H. SMITH: It seems to me that the suggestions put forth by Mr. Safro are certainly worthy of thinking over a good many times. I had the experience of starting out in spreader work. At that time I joined a commercial organization. I was told by a professional man (he wasn't a professional man but he was an entomologist connected with another organization) that although we didn't know the exact status of spreader, regarding whether or not it gave satisfactory control, we surely could make a get-away with it for at least fifteen years because it took at least fifteen years for the experiment station men to

come to any conclusion at all. When I was with this company I didn't agree with that fellow exactly. The main things that Mr. Safro has brought out is that we have performed experiments, we have looked at our results, but we have failed to check up on the reasons why. We get these variable results, and that means that we must get down to brass tacks on these things.

I stand, of course, subject to criticism for making this statement at this time, after working with the codling moth and after five years delving into the literature very extensively, but I almost feel like saying that half the literature is absolutely worthless.

Without criticism at all, Mr. Sullivan did present a very good paper about dusting versus spraying, and his results indicated that dusting was about as good as spraying. There are, literally, dozens of factors that might enter into making spraying one year much more effective than dusting. It isn't so much that we have gotten this particular result in this one set of experiments but the thing we must be interested in is why. The question entered my mind when Mr. Sullivan was giving his paper, did it rain when the dust or the spray was applied, or the next day or the third day after? Did the wind come up the night after the dust was applied? Many similar factors of that kind enter in and must be taken into consideration.

SECOND VICE-PRESIDENT LEROY CHILDS: The next is a paper by R. C. Smith.

HOUSE FUMIGATION WITH CALCIUM CYANIDE[1]

By ROGER C. SMITH, *Kansas Agricultural Experiment Station*

ABSTRACT

This paper embodies the results of 18 fumigations with calcium cyanide for household insects, covering a period of two years. After six more or less preliminary tests with different forms of the cyanide, various dosages, and methods of application, it was decided that two pounds of calcium cyanide granules, or "G grade" to 1000 cubic feet of space applied by spreading thinly on dry papers in tightly closed rooms, and left for twenty-four hours, should give satisfactory results. Temperatures and humidities were recorded. Usually some insects in vials closed with one thickness of cheese cloth were used as checks. In only two fumigations out of the 18 were the results unsatisfactory, and one of these is not regarded as being significant because of special conditions involved. Tarnishing of metals, discoloration of walls and

[1]Contribution No. 352 from the Entomological Laboratory, Kansas State Agricultural College. Acknowledgment is made to the American Cyanamid Company for the cyanide used in about a third of the trials and for suggestions; to Mr. H. L. Gui, Prof. J. W. McColloch, Mr. C. B. Keck and Mr. Elmer Jones for their assistance with the fumigations, and to Prof. W. L. Latshaw for suggestions regarding the chemical aspects of this work.

spotting of bath room equipment occurred in four fumigations in various degrees. In three cases it was probably due to an unfavorable secondary reaction resulting from an excess of moisture used; in the fourth it might have been due to the high humidity prevailing. An exact knowledge of the chemical reaction with water of the product is needed. It costs about one-third less to fumigate with calcium cyanide than with sodium cyanide; it is a simpler process, and less dangerous to the one doing the work. The odor in the houses lasting for from one to five days or more is objectionable. It is concluded that calcium cyanide is a promising substitute for sodium cyanide for house fumigation.

Calcium cyanide first became available at Manhattan, during the Spring of 1923. It was promptly planned to give it a trial in house fumigation. This paper is a summary of these tests to date.

Sullivan (1924) has reported upon some house fumigations with this material for two species of fleas. He stated that "Calcium cyanide used at the rate of four ounces per 100 square feet will give practically 100 per cent kill in closed buildings." He also stated that eight ounces to 100 square feet would give the same result in open buildings. In one experiment he obtained apparently satisfactory results with one ounce of calcium cyanide flakes to 100 cubic feet of space on a first floor and basement of a modern dwelling. Two ounces of flakes to 100 cubic feet of space in a basement gave similar results in another test.

The American Cyanamid Company, in its leaflets and through its agents, has recommended one pound of "A" dust to 1000 cubic feet for eight hours, as stated by Hungerford (1925).

The method used in the tests reported in this paper, with the exception of the first two trials, is largely that used by Sullivan, but embodying in addition suggestions of Dr. Moore, given orally and in correspondence. The method was varied somewhat in the tests as indicated. In all cases, the buildings were prepared as for hydrocyanic acid gas fumigation, generated from sodium cyanide. Table I gives a summary of all the tests made in the period 1923 to November 1, 1925.

Discussion of Individual Trials. The first experiment will be discussed rather fully because of the method followed and the interesting results obtained. The building, which was a comparatively new, well-built bungalow, had the basement severely infested with dog fleas. Since they had been carried to the rooms above, it was thought that a complete fumigation was necessary. Calcium cyanide was then new and, to the writer's knowledge, no experiments with it in house fumigation had been made. It was reasoned that sufficient moisture should be applied to set free the gas quickly so as to surround the insects with a lethal dose in the first few minutes, as occurs in sodium cyanide fumigation. Moore (1924) states that the concentration of the gas to which

the insects are exposed is of more importance than the length of exposure. Since the gas evolves relatively slowly when the flakes are scattered on the floor or ground, it was decided to place the cyanide in pasteboard boxes, buckets or pans and then pour a small amount of water equal to about half the volume of the flakes over them. All of these containers were tried. Precautions were taken to prevent damage to the floors.

The insects in the check cages consisting of May beetles, ground beetles, and alfalfa insects, because they happened to be easily obtained, were all dead in three hours. The house was opened after twenty hours and no live fleas were found then or later. Severe tarnishing, however, resulted. The leather cover of a thermos bottle in the dining room appeared as if it were covered with frost or mildew. The silver candle sticks, electric fan, chandeliers, and silverware were severely tarnished by a brownish or smoky deposit. The white enameled wood work in the bath room and kitchen, the white wainscoting, the bath tub and stool had large brownish or reddish blotches on them, apparently where water had at some time previously been splashed on them, or where they had been wiped with a damp rag. It appeared as if dirty water had been splashed on the woodwork and dried. It was thought that soap in the water is in some way responsible for the blotches, for clean water leaves no residue when it evaporates. The walls of the bath room, which were painted blue, had a very distinct reddish or pinkish tinge after the fumigation, and the walls in the two front rooms, which were painted brown, had a marked reddish tinge.

Soon after the start of the fumigation, the cyanide in the bucket in the dining room foamed up and ran over. The door was opened slightly and an effort was made to drag the bucket out with a long pole. But as soon as the door was opened, the gas fumes came out so strongly that a severe smarting of the eyes was experienced.

Moore (1924) states that "if sufficient water is used to wet the material, another reaction occurs in which the hydrocyanic acid decomposes under alkaline conditions, with the formation of ammonia and other little known compounds, one of which is often referred to as azulmic acid." This ammonia, then, in Dr. Moore's judgment, caused the smarting of the eyes and the discoloration, instead of some impurity in the flakes, as the writer suggested. He stated further (1924) that "if the flakes are placed in buckets or jars and water poured over them, a solution of calcium cyanide will be formed which does not give off hydrocyanic acid any more rapidly than a similar solution of sodium cyanide."

TABLE I—FUMIGATION TESTS WITH CALCIUM CYANIDE FOR ERADICATION OF HOUSEHOLD PESTS

House number	Date	Insect	Check	Temperature[1]	Humidity[1]	Form of cyanide	Rate per 1000 cu. ft.	Type of building	Total amount used	How applied	Length of time exposed	Results	Check	Remarks
No. 1	7-12-23	Fleas	Alfalfa sweepings in screen cages	83°F.	85	Flakes	3 lbs. to 1600 cu. ft.	New bungalow	25 lbs. to 9991 cu. ft.	Various	20 hrs.	Satisfactory	All killed in 3 hrs.	Tarnished leather and silver, spotted woodwork, discoloredthewalls
No. 2	7-18-23	Fleas	None	87°F.	80	Flakes	2 lbs. to 1600 cu ft.	Basement	8 lbs. to 6400 cu. ft.	Pasteboard boxes. Poured water on it	28 hrs. 1 week	Partial. Complete in few days		No damage done
No. 3	8-10-23	Bed bugs	None	96°F.	74	Flakes	3 lbs. to 1600 cu. ft.	Old two-story residence		Spread on dampened paper	24 hrs.	Satisfactory		No damage done
No. 4	4-11-24	Bed bugs	Ground beetles, etc.	81-75°F.	43-53	Granules	3 lbs. to 1600 cu. ft.	Bungalow	9½ lbs. to 4621 cu. ft.	As above	24 hrs.	Satisfactory	All dead	Slight tarnish on typewriter and alarm clock
No. 5	6-7-24	Bed bugs	Chryso-melids & alfalfa sweepings	70-80°F.	82-86	Flakes	2 lbs. to 1000 cu. ft.	Old two-story residence	19 lbs. to 7800 cu. ft.	As above	8½ hours	Satisfactory	All killed. 1 ladybird beetle revived in open	No damage done.
No. 6	6-11-24	Bed bugs	Silkworms Alfalfa sweepings	73-83°F.	100-82	Granules	1½ lbs. to 1600 cu. ft.	Old two-story residence	8 lbs. to 7369 cu. ft.	As above	22½ hrs.	Satisfactory	All dead	Woodwork discolored. Silverware & sewingm'ch'ne tarnished
No. 7	10-13-24	Ants	None	68°F.	88	Flakes	Indefinate	New bungalow	Indefinate	In between walls; under soil in basement	9 hrs.	Satisfactory		No damage done
No. 8	7-20-25	German cockroach	Cockroaches	79°F.	85	Granules	2 lbs.	Modern two-story residence	25 lbs. to 12,336 cu. ft.	Spread on dry papers	11 hrs.	Satisfactory	All dead	No tarnishing observed
No. 9	7-25-25	Fleas	Fleas	82°F.	87	G Grade	2 lbs.	Two-story residence	50 lbs. to 25,757 cu. ft.	Spread on papers	24 hrs.	Satisfactory	All dead	No tarnishing or spotting noted

No. 10	7-22-25	Fleas	Fleas	71°F.	76	Granules	2 lbs.	Two-story residence	42 lbs. to 19,364 cu. ft.	Spread on dry papers except on porch	21 hrs.	Satisfactory	All dead	No tarnishing or discoloring observed
No. 11	7-26-25	Angoumois grain moths Clothes moths	None	80°F.	85	G Grade	2 lbs.	Modern bungalow	20 lbs. to 10,420 cu. ft.	Spread on dry news papers	20 hrs.	Only partial kill		Silverware tarnished. Brownish deposits on woodwork & bath tub
No. 12	8-1-25	Indian meal moths	None	73°F.	65	G Grade	1 lb.	New grain barn. Two floors	50 lbs. to about 50,000 cu. ft.	Spread on dry papers	38 hrs.	Successful		No damage observed or reported
No. 13	8-29-25	Cock-roaches	None	84°F.	60	G Grade	3 lbs.	Old re-modeled store room	50 lbs. to 15,364 cu. ft.	Spread on dry papers	23 hours	Unsuccessful		No damage observed or reported
No. 14	9-1-25	Fleas	None	83°F.	60	G Grade	2 lbs.	Two-story residence	45 lbs. to 22,154 cu. ft.	Spread on dry papers	25 hrs.	Satisfactory		No damage observed
No. 15	9-7-25	Fleas	None	83°F.	72	G Grade	2 lbs.	New garage	3 lbs. to 1440 cu. ft.	Spread on dry papers	24 hrs.	Satisfactory		
No. 16	9-9-25	Fleas	None	79°F.	87	G Grade	2 lbs.	Residence 2 floors	30 lbs.	Spread on dry papers	18 hrs.	Satisfactory		No damage done
No. 17	6-25-25	Fleas	Fleas 5 vials	76°F.	90	Flakes	1 to 2 pounds	Residence 2 floors and basement	22 lbs. to 15,072 cu. ft.	Spread on dry or dampened papers	17½ hrs.	Satisfactory	All inside dead. All on porches alive	No damage done. Flakes not exhausted
No. 18	7-3-25	Bed bugs	Bed bugs in vials under Ledding	98°F.	86	G Grade	2 lbs.	Residence 2 floors	5 lbs. to 2780 cu. ft.	Spread on dry news papers	25 hrs.	Satisfactory	All dead	No damage seen nor reported

[1]Temperature and humidity computations in houses 1 to 7 were obtained from a hygrothermograph in the buildings; in 18, from wet and dry bulb thermometers and for the rest, averages of readings at the college for the period of the fumigation are given. All of these records are regarded only as approximate.

It is well known that hydrocyanic acid gas is dissolved readily by water, forming prussic acid.

Fortunately, all the deposits or discolorations wiped off easily, and after several weeks, the reddish tinge of the painted walls disappeared without any treatment. There was, however, as a result of the fumigation, a distinct odor in the house for several weeks, but the occupants apparently did not object to it, and it gradually disappeared.

In house No. 2, only the basement was infested with dog fleas. Half of the basement was cemented and half was dirt floor. The eight pounds of calcium cyanide flakes were divided into three lots and placed in pasteboard boxes lined with paper and about a pint of water poured over each of them. Salt was sprinkled on the floor of the basement to drive the fleas up off the floor. The odor of gas was strong, and was detected as much as 100 feet on three sides by neighbors. After 28 hours, an examination revealed some live fleas, but in greatly reduced numbers. The owner then decided to close up the basement and leave it to fumigate longer. The writer objected strongly to this, since the owner was planning to occupy an upstairs room. Nevertheless, he did it without injury to himself, and in a week reported the fleas all gone. No injuries to anything were observed or reported.

About the time house No. 3 was fumigated, the writer was informed by Dr. Moore of the method used in Missouri, viz., of scattering the cyanide on lightly dampened newspapers. This house, which was a very poorly built shack of three rooms, crowded with old furniture and clothing, was fumigated according to this method. After 24 hours, nothing alive was found and no damage was done. The idea of bringing about a rapid evolution of gas was abandoned and greater reliance placed on longer exposure, a principle found to be effective by Saffro (1924).

House No. 4 was much like No. 3; that is, poorly built and much crowded. The granular form of the cyanide was used here for the first time and was spread on papers as before. The fumigation was a complete success. The linoleum in the kitchen was stained slightly under the cyanide, the discoloration suggesting scorching. Since the owner did not have sufficient newspapers to spread on the floor, the spot was not a surprise. It has since been found that a half dozen thicknesses of newspaper over linoleum are none too many. Slight tarnishing afterwards was observed on the typewriter and an alarm clock, but they were so slight that the owner did not even see them. The fumigation was entirely successful.

House No. 5 was a very large old rooming house, poorly built and full of old furniture. The occupants could not leave for more than eight hours, so the time of exposure was shorter than in previous fumigations. The cyanide was placed on slightly dampened papers.

The fumigation was apparently successful, since no reports of further infestation were ever made. No tarnishing was observed or reported. Since one beetle in a check cage revived, it was thought that the results were not successful. But since the owner, who is the janitor of a college building and is seen daily, never reported finding bugs subsequently, the results were apparently satisfactory.

House No. 6 was a well-built, remodeled old house only occupied about two weeks by a newly married couple. Granules were used in this fumigation. They were scattered very thinly and uniformly on slightly dampened papers. Particular precaution was taken with checks. As in the previous fumigations, whatever insects could be had quickly or conveniently were used. In this case, the insects obtained from alfalfa sweepings and about a dozen boxes containing silk worms were used. They were placed in different places in the house; in the bed, under covers, under carpets, in a trunk, in a bureau drawer, above the door, and in a closet. As a result of this fumigation, all the check insects were dead. It appeared that they had been killed quickly and suddenly. Some appeared to have been killed while eating. No further infestation was ever reported. There was some discoloration in the building, but it was not serious, and very likely if attention had not been called to it, it would not have been observed by the occupants. The discoloration pertained to the white, newly painted, woodwork similar to that of house No. 1. It was less extensive and came off with Sunbright cleaner. The silverware, alarm clock, the nickelplating on the sewing machine, and some cooking utensils were slightly darkened or tarnished. In an attic above the kitchen which was also fumigated, the owner put too much water on the paper and as a result caused a brown spot about a foot square in the ceiling below. These discolorations, except the ceiling spot, were not serious and the fumigation was considered as a complete success.

House No. 7 was a poorly built but not very old bungalow. Ants of the species *Lasius* (*Acanthomops*) *interjectus*[2] had entered the basement through cracks in the cement floor and had carried in several bushels of soil. This soil was scooped from over the cracks, about a pint of the granules scattered over them and then covered with the soil.

[2]These ants were determined by M. R. Smith.

The ants were apparently destroyed, since no activity was observed or reported later. No discoloration or similar damage was done.

In houses No. 17 and 18, particular attention was given to the checks. In both cases, vials of the offending insects, closed with one thickness of cheese-cloth, were placed in different rooms, in beds, or variously secreted. Other vials were left outside of the house to see if any insects died because of the confinement. In No. 17, the amount of materials and method of application was varied. One pound of calcium cyanide flakes to 1000 cubic feet, spread on dampened papers, was used on the first floor; two pounds to 1000 cubic feet, spread on dry papers, was used upstairs and in the basement. In both houses, the insects in the vials in the rooms were all dead at the end of the fumigation, while those in the vials outside were all alive. Both fumigations were entirely successful and no discolorations were seen or reported.

Tests numbers 8 to 16 inclusive can be discussed together, for the same method was followed in all. From the earlier fumigations, and because of the cyanide content of the product, it was decided that in the usual house fumigation, two pounds of calcium cyanide to a thousand cubic feet of space and left for 24 hours should be ample. The granular form, or G grade, was selected for further tests, because the smaller particles, theoretically at least, should give off the gas more rapidly than the flakes. The "A" dust was not yet available at Manhattan, and the granular form was the finest grade obtainable, except the dust mixtures. It was decided to spread them thinly on dry newspapers, unless the humidity was exceptionally low. Then a very light sprinkling of the papers before spreading the granules would be resorted to, which was done only on the porch of No. 10.

In the second series, only numbers 11 and 13 were unsatisfactory. The owner said that house No. 11 was infested with clothes moths, but it was learned several months after the fumigation that the moths seen were Angoumois grain moths. They were breeding in a jar of old popcorn which had been forgotten. Probably there were some clothes moths present at or before the fumigation, for injuries were seen, but if they were there at the time of the fumigation, all succumbed, for no new injuries were observed afterwards. Some dead angoumois grain moths were found after the fumigation, but the owner reported seeing many live ones about three weeks later. The fumigation was done on a hot, sultry day. There is indicated here, as well as in other fumigations, that there may at times be sufficient moisture in the air to cause tarnish-

ing and spotting, for no moisture was used on the papers in this fumigation.

This house was again fumigated in the same manner, Jan. 15, 1926. This was a warm, winter day, and a good fire had previously been made in the furnace to raise the temperature to 70° or higher. The humidity was about 45 per cent. The fumigation was continued for 27 hours. Only a small per cent of the Angoumois adults were killed. No tarnishing or spotting of any kind was observed as a result of the fumigation. Adults emerged from the popcorn after the fumigation, so it appears that this material is unsuccessful for Angoumois grain moths. It is known, however, that this moth is very resistant to HC_n, though this method of exterminating them is usually given in bulletins.

The blotches on the white woodwork and bath tub following the earlier fumigation again strongly suggested a connection with soapy water.

The American Cyanamid Company states that calcium cyanide granules contain not less than 40 per cent nor more than 50 per cent calcium cyanide. It seems highly probable that the remaining 50 or 60 per cent of the product consists largely of unconverted $CaCn_2$, or calcium cyanamid and some calcium hydroxide. The following reactions are given in the American Cyanamid Company's leaflets (1, p. G 1).

(a) $CaCn_2+3\ H_2O=Ca\ (O\ H)_2+CO\ (N\ H_2)_2$

(b) $Ca\ (CN)_2+2\ H_2O=Ca\ (O\ H)_2+2\ H\ Cn.$

"When calcium cyanide is acted upon, by moisture, urea is formed, whereas when calcium cyanide is acted upon by atmospheric water vapor, hydrocyanic acid is given off." The ammonium compound $CO\ (N\ H_2)_2$ of (a) is a weak base which might be dissociated by $Ca\ (O\ H)_2$, a strong base, with dry ammonia gas resulting. This might react with certain paint pigments and dyes and might explain the discolorations obtained in fumigation No. 1, and in some others where there was a high humidity. It is evident by comparing the above reactions that more water is required for (a) than for (b).

The odor which follows fumigations with calcium cyanide is perhaps explainable for the reason that certain materials about rooms might absorb the ammonia gas and perhaps other gases evolved until a high concentration is reached. Upon airing out the house, these absorbed products would be given off until equilibrium, or, in this case, normal conditions are attained. But the final explanation depends on an exact knowledge of the chemical composition of calcium cyanide and its chemical behavior under fumigating conditions.

A part of the tea room, No. 13, was refumigated when it was found

that there were still present live cockroaches after the first fumigation. Only the kitchen and store-room (7752 cu. ft.) were refumigated. A very heavy charge of 25 pounds was used. As before, a great many dead roaches were found, but apparently many were not reached, since live ones were seen several days later. A reinfestation after the first fumigation from buildings, including a restaurant near by, is a possibility. There was no basement under the building, and the live cockroaches, after the fumigations, may have come from under the building. We are not inclined to regard this trial as a significant failure, for there was a very heavy kill of roaches at each fumigation, and also one rat in each case. It was a special condition which possibly was not fully met. The tea room had been fumigated a year previous with sodium cyanide, so that the reinfestation strongly indicates migrations from near-by buildings. One or more dead mice were found after perhaps a third of these fumigations. They were usually in plain view in the rooms and not in their usual hiding places.

General Summary and Conclusions. There are only two unsatisfactory trials in the eighteen, one of these, No. 13, not being regarded as significant. Therefore, calcium cyanide may be said to be a promising substitute for sodium cyanide for house fumigation. Two pounds to 1000 cubic feet of space in the average, fairly well-built residence, in general, proved satisfactory. The minimum dose is, of course, somewhat less than this amount, but it is thought that it is advisable to use an excess to meet the variety of conditions under which it would be certain to be used. The twenty-four hour period for the fumigation is longer also than necessary, at least in most cases, but the longer period was used to insure satisfactory results. All the tarnishing and spotting, except in No. 11, may have been due to the use of moisture, and thus in later fumigations no water was used and a longer period of exposure was urged upon the tenants. There is no clear evidence that changes in temperature and humidity occurring during these fumigations influenced the results. There is a suggestion that spotting may be more severe at high humidities than at low ones.

The advantages of the substitution of calcium cyanide for sodium cyanide in house fumigation are:

1. It is easy to use. The handling of the sulphuric acid, which is the most disagreeable part of sodium cyanide fumigation, is eliminated. This method requires few instructions and little or no skill to carry it out. Injury by the acid to floors, carpets and clothing is eliminated.

2. The danger in using the gas is reduced. The gas evolves more

slowly than with sodium cyanide, allowing the operator plenty of time to get out from difficult places. The odor of the gas or gases involved might serve as a warning to persons about to enter a house in the process of fumigation.

3. It is cheaper to fumigate a house with calcium cyanide at the rate of two pounds to 1000 cubic feet than with sodium cyanide at the rate of one pound to 1600 cubic feet. It requires no equipment other than a good supply of newspapers, or wrapping papers, a paper sack for each room, and a scales for weighing the cyanide.

The retail prices per pound at Manhattan for calcium cyanide flakes and for the G grade, or granules, in five-pound cans is forty-five cents; in 25-pound cans it is thirty cents.[3] Sodium cyanide sells for seventy-five cents a pound in a one-pound package, and sixty cents a pound in five-pound containers. Commercial sulphuric acid is thirty cents per pint, or fifty cents a quart, where containers are furnished. Calculating labor at fifty cents an hour and using calcium cyanide at two pounds to 1000 cu. ft., and sodium cyanide at one pound, one and one-half pints sulphuric acid to 1600 cu. ft. (or 1000 cu. ft. in basements), a comparison of costs in fumigating several of the houses listed with the two formulae is shown in Table II. The labor cost in the calcium cyanide fumigations is in all cases the exact amount paid for these fumigations. The labor cost in the sodium cyanide fumigations is an estimate based on an average of fifteen minutes of time necessary to accomplish all the operations for each room fumigated.

TABLE II. COMPARATIVE COSTS OF FUMIGATING CERTAIN HOUSES WITH CALCIUM CYANIDE AND WITH SODIUM CYANIDE

	Actual cost of fumigating with calcium cyanide			Estimated cost of fumigating with sodium cyanide				
House number	Labor	Materials	Total	Labor	Cyanide	Acid	Crock rentals 15c each	Total
8	$1.50	$7.50	$9.00	$1.25	$6.00	$3.38	$1.65	$12.28
9	2.00	15.00	17.00	2.25	10.80	8.07	1.95	23.07
11	1.00	4.50	5.50	1.00	3.60	2.25	.90	7.75
16	2.00	9.00	11.00	1.25	8.40	5.25	1.50	16.40

The difference in cost is chiefly due to the saving in eliminating the acid, which involves, in addition to its own cost in nearly every house fumigation, a rental of crocks to contain the mixture. The local rate for rental is twenty per cent of the value of the crocks. In addition to this charge, about one in every twelve crocks used will be broken and will have to be paid for by the one renting the crocks. Breakage was not included in these estimates.

[3] The retail price quoted by the company is thirty-four cents a pound in 25-pound cans, and in 5-pound cans it is fifty cents a pound.

The following objectionable features were observed:

1. Discolorations and tarnishing of leather goods, nickel and silver-plated objects and of white woodwork may occur. In houses Nos. 6 and 11, no satisfactory explanation of this can be made. These discolorations, while not serious, are objectionable. We need to know more about the chemical composition of calcium cyanide and its reactions before a final explanation can be given.

2. There is a discernible odor in the house for a day to as much as a week or more. No one has reported this as seriously objectionable, but it will likely prove to be objectionable to some. Airing out the house does not eliminate the odor. It disappears gradually with or without airing. Since this odor does not follow sodium cyanide fumigation, there must be some impurity, or chemical reaction responsible for it. Perhaps the odor will be explained when the tarnishing and spotting is understood.

Suggested Precautions in Using Calcium Cyanide for House Fumigations

1. It should be weighed out doors to lessen the danger from the gas. One should work rapidly, for gas is given off then, as indicated by the slight change in color.

2. The material should be scattered very thinly on the papers. If piled up, the covered portion does not give off all or any of its gas.

3. There was some indication that granules are better than flakes for house fumigation, that small particles give up a larger percentage of their gas in a given length of time than larger ones. When the flakes were removed at the end of the fumigating from houses numbers 5 and 17, some of the flakes appeared wholly unchanged.

4. Place plenty of newspapers on the floor. The cyanide may stain the floor and especially linoleum through one or two thicknesses of paper.

5. Until its action and use are better understood, the dampening of the papers before sprinkling the cyanide on them should be omitted. It appears to be unnecessary generally, and causes an increase in discoloring.

6. Especial attention should be given to airing out rooms before entering. Sometimes the gas persists in closets and basements. An electric fan was found useful to facilitate this part of the work.

Literature Cited

1. American Cyanamid Company. Leaflets entitled "Research in the Development of Calcium Cyanide." Distributed November, 1925.

2. HUNGERFORD, H. B. Insect Pests about the House. *In* the twenty-fourth Biennial Report, Kansas Board of Agriculture, 1924, pp. 83–120. (Reference on p. 116–117).
3. MOORE, WILLIAM. Calcium cyanide. Jour. Econ. Ent., 1924. 17:104–106.
4. SAFFRO, V. I. Calcium Cyanide as a Greenhouse Fumigant. Jour. Econ. Ent., 1924, 17:667.
5. SULLIVAN, K. C. The use of Calcium Cyanide for the Control of Fleas and other Insects. Jour. Econ. Ent., 1924, 17:230–237.

(At this point Acting President R. N. Chapman assumed the chair.)

ACTING PRESIDENT R. N. CHAPMAN: Do you wish to take any action at this time in regard to the method of handling the program for the rest of the meeting? Shall we move the Saturday morning program up to Friday morning?

Upon vote, it was decided to proceed with the program as printed.

ADJOURNMENT: 5 p. m.

Friday Morning Session, January 1, 1926

The meeting was called to order at 9:45 by Acting President R. N. Chapman.

ACTING PRESIDENT R. N. CHAPMAN: We shall first return to the titles which were passed yesterday afternoon but which were scheduled for this morning.

The first paper this morning is by C. O. Eddy.

STUDIES OF SOME ADSORBED INSECTICIDES

By C. O. EDDY, *South Carolina Experiment Station*

ABSTRACT

Preliminary tests at the South Carolina Experiment Station by the writer show that chewing insects like the potato beetle (*Leptinotarsa decemlineata* Say) and the Mexican bean beetle (*Epilachna corrupta* Muls.) can be killed and controlled by adsorbed insecticides. Soluble arsenicals, sodium arsenate, sodium arsenite, potassium arsenate, and potassium arsenite carried by dusts of kaolin, diatomaceous earth, Fuller's earth, talc and tripoli were used.

Chemical analyses showed that when these carriers are mixed with quantities of aqueous solutions containing a water soluble arsenical that will just thoroughly wet the carrier and then dried, that they will retain only a very small portion of the arsenical (less than 1%) arsenic As_2 in a way to prevent it from being water soluble when the dust is analyzed for total and water soluble arsenic. The amount of arsenic adsorbed is variable and in this case seems to depend chiefly on the carrier and to a less extent on the arsenical. When sodium hydroxide was used with the toxins the adsorbed arsenic was decreased.

When the carriers were mixed with a large excess of the soluble arsenical solutions

and then washed, filtered, and dried, the quantity of arsenic carried from the solutions averaged larger than that adsorbed in the previous experiment. The amount of arsenic carried from the solutions depended chiefly on the carrier used and to a less extent on the arsenical. The order of the carriers when arranged according to the relative amount of arsenic carried out of the solutions is different from that of the first experiment when arranged according to the quantity of arsenic adsorbed.

Introduction

Preliminary tests at the South Carolina Experiment Station by the writer have shown that chewing insects, like the potato beetle (*Leptinotarsa decemlineata*) and the Mexican bean beetle (*Epilachna corrupta*), can be killed and controlled by small amounts of toxins carried by cheap materials like kaolin, diatomaceous earth, Fuller's earth, talc, and tripoli in dust form.

Of the several adsorbed insecticides which were tried during the last season, it was found that some would kill insects. It was also found that certain of them burned the plants severely, while others caused very little or no burning. Of course, this burning depended both upon the toxin used and the nature of the carrier. We found that we needed to know more about the relationship between the toxins and the carriers before we could go farther with this problem. The section of the problem which is reported in this paper concerns only a few carriers and one group of poisons.

Object of Experiment

This experiment was performed as a preliminary step in an effort to produce a cheaper arsenical that would be effective in controlling chewing insects.

The Problem

The relationship of four water soluble arsenical compounds—sodium arsenate, sodium arsenite, potassium arsenate, potassium arsenite—to each of the carriers—kaolin, diatomaceous earth, Fuller's earth, talc and triploi—is derived by the use of the analyses made for total arsenic and water soluble arsenic by the methods outlined in "Official Methods of Analysis of American Association of Agricultural Chemists." Chapter V, paragraphs 5 and 13.

All the chemical analyses reported in this paper were made by Professor J. H. Mitchell, Chemist, South Carolina Experiment Station, Clemson College, South Carolina.

EXPERIMENT 1

SECTION A

Method

The amount of the arsenical required to make a dust of a given arsenic (As_2) content was dissolved with the quantity of water that would thoroughly wet the carrier, which was then added to the solution and mixed with it quickly, vigorously and thoroughly. This mixture was then dried in a gas oven at a temperature ranging from 80–100 degrees centigrade. Eighteen to thirty-six hours were usually required for drying. When dry this material was hard and often stone-like or flinty, so that it was necessary to break it and then grind it in a ball mill or in a food chopper with special grinding blades, after which it was sifted thru a fine copper wire sieve in order to secure a uniform dust material.

Nine dusts with arsenic content varying from a very small to a very large amount, were made using every carrier with each arsenical. Each sample, when completed and in the form of a dust, was analyzed for total arsenic (As_2) and water soluble arsenic (As_2). The adsorbed or retained arsenic was obtained by subtracting the water soluble arsenic from the total arsenic. All figures are given in grams of arsenic (As_2) per 100 grams of dust.

SODIUM ARSENATE

TABLE I.—ANALYSES FOR THE TOTAL ARSENIC (T), WATER SOLUBLE ARSENIC (S) AND CALCULATED RETAINED OR ADSORBED ARSENIC (A) WHEN SODIUM ARSENATE WAS USED WITH THE CARRIERS

Kaolin			Tripoli			Diatom. Earth			Fuller's Earth			Talc		
T	A	S	T	A	S	T	A	S	T	A	S	T	A	S
.85	.20	.65	.91	.06	.85	.58	.20	.38	.72	.12	.60	.72	.19	.53
1.69	.63	1.06	1.24	.26	.98	.85	.20	.65	1.24	.39	.85	1.17	.06	1.11
1.82	.54	1.28	1.43	.06	1.37	1.95	.19	1.76	1.69	.03	1.66	1.37	.13	1.24
2.14	.40	1.74	1.82	.26	1.56	2.54	.27	2.27	2.34	.07	2.27	2.27	.19	2.08
3.52	.72	2.80	1.95	.19	1.76	3.06	.13	2.93	3.26	.16	3.10	2.61	.04	2.57
3.91	.66	3.25	2.22	.20	2.02	3.39	.07	3.32	3.97	.11	3.86	3.91	.20	3.71
4.40	.24	4.16	2.67	.20	2.47	4.82	.13	4.69	5.15	.16	4.99	4.95	.13	4.82
6.41	.15	6.26	5.54	.26	5.28	7.95	.26	7.69	7.63	.20	7.43	8.08	.13	7.95
11.21	.69	10.52	7.50	.20	7.30	10.56	.13	10.43	10.43	.26	10.36	9.84	.06	9.78
Ave.	.47			.18			.17			.16			.12	
Max.	.72			.26			.27			.39			.20	

SODIUM ARSENATE

Each one of the first four tables contains all the analyses, as well as the calculated figures for adsorbed or retained arsenic, that were made for any one arsenical. The toxin appears first across the top with the carriers just below. The three columns below each carrier are as follows: *T* which is at the top of the left column of figures under each carrier shows that the figures below are the results of analyses for total arsenic. *S* in the last column below each carrier shows that the figures below are the results of chemical analyses for water soluble arsenic. *A* is obtained

by subtracting the *S* or water soluble arsenic from the *T* or total arsenic and is placed between them. The first sample then shows an analysis of total arsenic .85, water soluble arsenic .65 and an adsorbed or retained portion of .20.

The total arsenic for each of the different samples appears in the left column of each group, headed by a carrier. They usually range from about .50 to 10. The amount of water soluble arsenic follows that of the total arsenic very closely, hence the middle or *A* column does not become very large.

The average and maximum for each *A* column is given directly below it. We shall be chiefly concerned, however, with the average of the *A* columns only in this section of the experiment.

The average quantity of arsenic retained by kaolin, when sodium arsenate is used (Table I) is much higher than that retained by any other carrier. It is .47. The average of that retained by tripoli is .18, by diatomaceous earth .17, by Fuller's earth .16 and by talc .12. The averages are arranged in descending order from left to right.

SODIUM ARSENITE

TABLE II.—ANALYSES FOR THE TOTAL ARSENIC (T), WATER SOLUBLE ARSENIC (S) AND CALCULATED RETAINED OR ADSORBED ARSENIC (A) WHEN SODIUM ARSENITE WAS USED WITH THE CARRIERS

Kaolin			Diatom. Earth			Fuller's Earth			Talc			Tripoli		
T	A	S	T	A	S	T	A	S	T	A	S	T	A	S
1.52	.74	.78	.85	.10	.75	.91	.06	.85	.85	.13	.72	.58	.16	.42
2.14	.71	1.43	1.17	.13	1.04	1.43	.13	1.30	1.11	.13	.98	.98	.07	.91
2.56	1.00	1.56	1.69	.26	1.43	2.10	.15	1.95	1.82	.39	1.43	1.04	.06	.98
3.05	.44	2.61	1.76	.26	1.50	2.74	.47	2.27	2.21	.13	2.08	1.82	.06	1.76
3.54	.54	3.00	3.00	.59	2.41	3.91	.07	3.84	2.27	.12	2.15	2.08	.13	1.95
4.58	.93	3.65	3.16	.29	2.87	4.76	.33	4.43	2.47	.13	2.34	2.69	.08	2.61
5.07	.97	4.10	3.85	.66	3.19	6.00	.20	5.80	3.72	.27	3.45	4.04	.13	3.91
7.03	.83	6.20	5.47	.19	5.28	9.06	.46	8.60	6.19	.26	5.93	4.27	.17	4.10
9.78	.39	9.39	8.34	.26	8.08	11.54	.39	11.15	8.15	.26	7.89	6.11	.18	5.93
Ave.	.61			.30			.25			.20			.11	
Max.	1.00			.66			.47			.39			.18	

SODIUM ARSENITE

Table II shows the results of a study, similar to that of Table I, of the quantity of arsenic adsorbed or retained by the carriers when sodium arsenite is used. Kaolin retains much more arsenic than the other carriers in this test also, an average of .61. Diatomaceous earth follows kaolin with an average of .30. Fuller's earth comes next with .25, then talc with .20 and tripoli with .11. The order of the averages is again arranged in descending order from left to right, but the order of the carriers is slightly different.

Potassium Arsenate

Table III.—Analyses for Total Arsenic (T), Water Soluble Arsenic (S) and Calculated Retained or Adsorbed Arsenic (A) when Potassium Arsenate was Used with the Carriers.

Kaolin			Fuller's Earth			Talc			Tripoli			Diatom. earth		
T	A	S	T	A	S	T	A	S	T	A	S	T	A	S
.72	.14	.58	.65	.12	.53	.45	.12	.33	.58	.19	.39	.39	.01	.38
.85	.27	.58	1.11	.13	.98	.58	.12	.46	.72	.14	.58	.65	.12	.53
1.17	.45	.72	1.30	.09	1.21	.91	.08	.83	1.04	.19	.85	.85	.10	.75
1.37	.33	1.04	1.95	.21	1.74	1.11	.13	.98	1.17	.26	.91	1.04	.06	.98
1.95	.21	1.74	2.15	.11	2.04	1.24	.18	1.06	1.43	.13	1.30	1.43	.22	1.21
2.87	.37	2.50	3.19	.32	2.87	1.69	.11	1.58	1.76	.20	1.56	1.76	.18	1.58
3.32	.75	2.57	3.52	.58	2.94	1.89	.23	1.66	2.67	.13	2.54	2.41	.14	2.27
5.20	.59	4.61	4.95	.65	4.30	4.82	.39	4.43	2.80	.19	2.61	4.17	.31	3.86
7.09	.66	7.03	6.45	.47	5.98	4.95	.45	4.50	2.93	.26	2.67	4.69	.30	4.39
Ave.	.41			.29			.20			.18			.16	
Max.	.75			.65			.45			.26			.30	

Potassium Arsenate

Table III reports a study similar to Table I or Table II, showing the quantity of arsenic retained or adsorbed by each carrier when potassium arsenate is used. Kaolin averages first again, retaining .41, Fuller's earth retains .29, talc .20, tripoli .18, and diatomaceous earth .16.

Potassium Arsenite

Table IV.—Analyses for the Total Arsenic (T), Water Soluble Arsenic (S) and Calculated Retained or Adsorbed Arsenic (A) when Potassium Arsenite was Used with the Carriers.

Diatom. earth			Kaolin			Tripoli			Talc			Fuller's earth		
T	A	S	T	A	S	T	A	S	T	A	S	T	A	S
.65	.23	.42	.78	.12	.66	.52	.13	.39	.52	.13	.39	.91	.13	.79
.98	.20	.78	.91	.11	.80	.98	.33	.65	.78	.13	.65	1.11	.13	.98
1.50	.39	1.11	1.37	.37	1.00	1.30	.13	1.17	1.04	.19	.85	1.50	.07	1.43
1.82	.39	1.43	1.82	.35	1.47	1.63	.26	1.37	1.24	.20	1.04	1.82	.19	1.63
1.89	.26	1.63	1.95	.14	1.81	2.21	.13	2.08	1.56	.26	1.30	2.34	.19	2.15
2.22	.33	1.89	2.08	.26	1.82	2.47	.32	2.15	2.15	.07	2.08	2.47	.20	2.27
2.54	.27	2.27	2.87	.19	2.68	3.59	.20	3.39	3.16	.23	2.93	4.17	.20	3.97
3.91	.30	3.52	4.82	.13	4.69	5.69	.13	5.54	3.19	.19	3.00	5.47	.19	5.28
5.54	.32	5.22	6.52	.36	6.16	6.91	.33	6.58	4.50	.33	4.17	6.32	.26	6.06
Ave.	.31			.22			.21			.19			.16	
Max.	.39			.37			.33			.26			.26	

Potassium Arsenite

Table IV reports a study, similar to the first three, with potassium arsenite and the same carriers. Diatomaceous earth retains the highest quantity here—.31, kaolin comes next with .22, and then tripoli with .21, talc with .19 and Fuller's earth with .16.

Table V.—Summary of the Averages of the Adsorbed (A) Columns from Tables I to IV Inclusive.

Carrier	Sodium arsenite	Potassium arsenate	Sodium arsenate	Potassium arsenite	Average
Kaolin	.61	.41	.47	.22	.42
Diatomaceous earth	.30	.16	.17	.31	.23
Fuller's earth	.25	.29	.16	.16	.21
Talc	.20	.20	.12	.19	.17
Tripoli	.11	.18	.18	.21	.17
Average	.29	.24	.22	.21	.24

Summary

The summary table (Table V) is a study of the averages of the *A* columns from the slides just shown. The carriers have been placed down

the chart in the left column and the toxins across the top. All the averages from the adsorbed columns shown in the previous tables have been placed opposite the proper carrier and toxin. For instance, the average quantity of arsenic retained by kaolin, when sodium arsenite was used, was .61.

Two columns for averages have also been added to this table. Each figure in the right column represents the average quantity of arsenic retained by the carrier opposite it in the first column, when all the toxins are considered. In other words, for kaolin it is the average of .61, .41, .47 and .22. The average amount of arsenic retained by all carriers with each arsenical is shown by the figures at the bottom of the chart.

The average quantity of arsenic retained by all carriers, when all arsenicals are considered, is the average both of the right column and of the figures across the bottom, and is shown in the lower right corner as .24.

The following statements are based upon the results of the chemical analyses just discussed

1. The quantity of arsenic retained or adsorbed by kaolin, diatomaceous earth, Fuller's earth, talc and tripoli, when analyzed for total arsenic and water soluble arsenic, is small, averaging between .17 and .42, with a general average of .24.

2. The quantity of arsenic adsorbed or retained depends chiefly on the kind of carrier and to a lesser degree on the form of arsenic used.

3. The carriers, when arranged in descending order according to the average quantity of arsenic retained or adsorbed, are as follows: kaolin, diatomaceous earth, Fuller's earth, talc and tripoli.

4. Kaolin adsorbed the largest quantity of arsenic, diatomaceous earth and Fuller's earth adsorbed about equal quantities and about half as much as kaolin, while talc and tripoli adsorbed about equal quantities, but only about seventy-five per cent of that adsorbed by diatomaceous earth and Fuller's earth, or about thirty-seven per cent of that adsorbed by kaolin.

5. In studying the relationship of different arsenicals used, in their effect on adsorption, it would seem that they are arranged in descending order with the greatest quantity adsorbed when sodium arsenite is used, and the least quantity adsorbed when potassium arsenite is used, but the great number of irregularities in the table as a whole, as far as this particular point is concerned, indicates that this relationship may be questioned.

Section B

Tables I to IV inclusive show that the *A* column is usually greater when larger percentages of total arsenic were used in the dusts. These figures were carefully studied by adding the *A* columns crosswise on these tables and also by adding them when they were arranged under one carrier, with the four toxins. This study, the details of which are not presented here, justifies the statement that as the amount of arsenic mixed in the carrier is increased, the retention or adsorption of arsenic usually becomes greater.

Section C

A less extensive experiment was performed similar to the first one except that one per cent of sodium hydroxide, and enough additional to neutralize all acidity of the toxins, was added to each sample. When sodium hydroxide is used in the quantity given above in preparting the dusts, the chemical analyses show: First, that the adsorption or retention of arsenic is decreased in practically every case; and second, that the relative position of the carriers as to the amount of arsenic adsorbed is changed.

Experiment 2

Object

This experiment was conducted to determine whether the relative quantity of arsenic these carriers would take from large excesses of arsenical solutions would be the same as in the preceding experiment.

Method

Twenty-five grams of each of the carriers—kaolin, diatomaceous earth, Fuller's earth, talc and tripoli—were placed in 200 c. c. of each of the four different toxin solutions containing approximately five per cent of arsenic. The carriers were left in the solution about forty-eight hours. These materials were placed in large bottles which were shaken occasionally during the two days. At the end of this time the carriers were removed from the solutions, washed and filtered. They were then dried and made into dusts ready for analyses. The analyses are for total arsenic only as it was necessary to determine only the quantity of arsenic that each of the carriers would take from a solution of each of the toxins.

Table VI.—Record of the Quantity of Arsenic Carried by Twenty-five Grams of Each Carrier form 200 c.c. of Solutions Containing about 5% Arsenic.

Carrier	Sodium arsenate	Potassium arsenate	Potassium arsenite	Sodium arsenite	Average
Kaolin	6.65	2.80	3.30	2.87	3.92
Diatomaceous earth	2.22	2.22	1.63	1.50	1.89
Tripoli	.58	.58	.65	.33	.53
Talc	.39	.46	.33	.33	.38
Fuller's earth	.33	.33	.33	.33	.33
Average	2.03	1.28	1.27	1.07	1.41

The carriers are placed in the left column of the table VI, the toxins across the top as before. Each number in the body of the table represents the quantity of arsenic which was taken from a solution of any one toxin by one of the carriers. Thus 6.65 represents the arsenic that was taken from the solution of sodium arsenate by kaolin.

Each number in the right column represents the average quantity of arsenic removed from the arsenical solutions by any one of the carriers. Thus 3.92 is the average quantity of arsenic carried from all the solutions by kaolin. One and forty-one hundredths (lower right corner) is the average quantity of arsenic carried out of the solutions by all carriers. The numbers on the lower line represent the average quantity of arsenic carried out of each kind of arsenical solution by all carriers.

The following statements are based on the results of the chemical analyses shown on this slide.

1. When the carriers are allowed to stand in large excesses of arsenical solutions of about the same arsenic content and then filtered and washed, the analysis for total arsenic varies chiefly with the carrier and less so with the arsenical.

2. Kaolin carried the largest quantity of arsenic from the solutions. Diatomaceous earth carried about fifty per cent as much, while tripoli, talc and Fuller's earth carried the least arsenic and about twenty per cent as much as diatomaceous earth or ten per cent as much as kaolin.

3. In studying the different arsenicals used in their effect on the quantity of arsenic carried out of solutions by the carriers, the table seems to show that when sodium arsenate is used, the largest quantity is carried out. When potassium arsenate and potassium arsenite are used, the next largest quantity is removed; and when sodium arsenite is used, the least quantity is taken. The differences in these figures are not as pronounced as those recorded in comparing the carriers, and therefore the relationship may be more indefinite and even variable.

4. The quantity of arsenic carried out of solution in this experiment averages larger than that adsorbed or retained by the carriers in experiment 1.

5. The relative position of the carriers in the quantity of arsenic which they carry out of solution is different from their order of adsorption in experiment 1.

Factors Influencing Results

1. Due to the colloidal condition of some of the carriers used, when in water, it was sometimes difficult to get a clear aliquot for analysis.

This would tend to increase the water soluble arsenic and make the record for adsorption, the *A* column, less than it should be.

2. The carriers were variable in both chemical and physical properties. The chemical analyses of the different carriers were, of course, very different. There was also some difference in the chemical analyses of the same kind of material when secured from the same mines. Thus, some shipments of tripoli had a very high iron content and other shipments, a very low iron content. This seemed to influence the physical reactions also.

The variation in physical properties that seemed to affect this problem most was the colloidal nature of the materials. This varied greatly with the different carriers as well as with different batches of the same carrier. Other varying factors were density, screen analyses and water content.

Concluding Statements

The experiments this summer indicate that this type of poison has possibilities of becoming an effective dust for chewing insects. Since small amounts of toxins are used with very cheap carriers, the product should be less expensive than other arsenical poisons.

This paper shows that the relation between soluble arsenicals and the carriers used is variable and can be modified. Some of these combinations have killed insects without burning plants. Since it is not known just what relation between arsenical and carrier will be most effective in killing insects with no danger to plants, these results should make a good foundation for such a problem.

Mr. F. L. Simanton: Did you indicate whether these arsenicals remain in the dust in the same form as they were before?

Mr. C. O. Eddy: I don't even know whether there is a chemical change or whether the total arsenical was absorbed. This is merely a result of analysis.

Mr. F. L. Simanton: Did you use lime?

Mr. C. O. Eddy: No, we did not.

Mr. F. L. Simanton: Which of the arsenates was most effective?

Mr. C. O. Eddy: I didn't notice so much difference between the sodium and potassium arsenates. We found that sodium arsenite, I believe, was more effective than some of the others.

Mr. S. Marcovitch: I should like to ask Mr. Eddy what was the effect on the foliage.

MR. C. O. EDDY: When we used the smaller percentages of arsenic, we had no burning and no effect on foliage, and oftentimes then killed our insects. When we used our larger percentages, however, we obtained very severe burning, showing that we will have to keep the arsenical very small and the water soluble content even below .75.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by W. S. Regan.

THE PRESENT STATUS OF OIL SPRAYING IN THE NORTHWEST

By W. S. REGAN, *California Spray-Chemical Co., Yakima, Wash.*

ABSTRACT

Home-made and central plant manufacture of the so-called, cold-mix, caseinate oil emulsion, during the past two years, and the indiscriminate use of this material have been the main causes for the suspicion and disfavor with which oil spraying in general is looked upon at present in the Northwest. Investigation has shown that the kind of emulsifier and method of emulsification of spray oil are practically as important as the oil itself, from the standpoint of safety and efficiency. The preparation of dependable oil sprays, therefore, involves technical ability, which can best be furnished by the insecticide chemist or specially trained entomologist. A highly refined, colorless oil emulsion has proven a safe and effective ovicide for the Codling Moth, *Carpocapsa pomonella*, and has been used successfully as a summer control for San Jose Scale, *Aspidiotus perniciosus*. The use of any dormant type of oil spray, even at low percentages, during the growing season is a dangerous practice. There is considerable evidence that oil sprays will soon return to favor in the Northwest.

The field of oil spray investigation has ever been an interesting one. Those who have followed this line of research to any extent appreciate fully the complexity of the subject and are usually slow to suggest a radical procedure until it has been thoroughly tested under as varied conditions as possible.

Spray oils had been enjoying comparative "peace and quiet" in the Northwest until about two years ago. In the spring of 1924 there was a sudden shift on the part of the growers of the Wenatchee fruit district to oil spray for the dormant application. A new era in the "spray game," as it were, had arrived. It was no longer necessary to pay a "high price" for commercial oil sprays or lime-sulphur. All that was required, so the grower was informed, was simply to buy his own stock oil, agitate it with some water and calcium-caseinate spreader and it was ready for application. It would cut the cost about in half. There was really nothing to it. Central plants for preparing the caseinate emulsion sprang up in a short time at many points and there was great activity in oil spraying.

Before the season was very far advanced many growers had reason to

suspect that all was not well. As the season wore on they were fully convinced of this and by harvest time some were even willing to be quoted as saying that the initial cost of such an oil spray was by no means the last cost. Many reported that they were "off oil sprays for good." This same condition was repeated in the Yakima Valley in 1925.

At present oil sprays occupy a position of suspicion or total disfavor among the majority of fruit growers of the Yakima and Wenatchee fruit districts of the Northwest. Perhaps this is little to be wondered at, in view of the fact that many of the samples of both home-made and central plant-made caseinate emulsion, seen by the writer the past season, were little more than curdled masses of emulsifier and free oil. Add to this the practice of some growers of spraying with dormant strength after the trees were well out in foliage—and even in full bloom in some cases—and the reasons are apparent for this unpopularity of oil spray.

Due allowance should be made for the worthy purpose of those who initiated the home-made spray oil idea. This was primarily to save the fruit grower money. From a practical standpoint, however, if the experience of the Northwest can be accepted as evidence, the average grower has lost many times what he has saved by attempting to make and handle his own product. Many fruit crops have been ruined and many trees severely injured by the use of oil spray prepared by persons who scarcely knew what they were attempting. There was, furthermore, widespread complaint of unsatisfactory results in the control of San Jose Scale from the use of this material.

The mere agitation of water and oil with an emulsifying agent does not insure an oil emulsion that will be safe to use on fruit trees or effective as an insecticide. Recent investigation has shown that the kind of emulsifier and the method of emulsification of an oil spray are practically as important as the oil itself.

If the foregoing facts are freely interpreted they show rather conclusively that the preparation of oil sprays is a field which belongs strictly to the experienced insecticide chemist or specially trained entomologist. Persons who are without technical training and experience along these lines are assuming serious and unwarranted responsibility when they presume to advise the fruit grower on the preparation of his oil spray. The grower in turn is assuming a risk that may result in justified, if not altogether wise, hostility towards oil sprays in general and a further contempt for an all too prevalent type of so-called "expert advice."

The Dormant Oil-Arsenate of Lead Combination

Early the past season another rather radical procedure was initiated in the Northwest with apparently little, if any, real experimental foundation for its adoption. Word went forth that by combining a 1% dormant type, caseinate oil emulsion (with ⅔ of 1% actual oil content) with arsenate of lead in the cover sprays this oil would afford a control for aphis; would act as a spreader for the arsenical and would kill the eggs of the Codling Moth. The possibilities of this combination were impressive and believing it to have been previously tested, the writer himself suggested to a number of growers that they give it a trial. As soon as the time arrived for the cover sprays, in cooperation with W. A. Luce, Horticultural Investigator for Chelan County, some tests were made in orchards at Wenatchee, Wash., to determine the effectiveness of this oil-arsenate of lead combination for the purposes stated. We also had occasion to observe the effect of this combination in several orchards throughout the season, when applied under commercial orchard conditions.

Our tests and observations indicated:—

(1). That ⅔ of 1% of brown neutral oil in the caseinate emulsion has little insecticidal effect upon the apple aphis. Reported effective results may possibly be due to high pressure spraying where the insects are blown off the shoots, rather than actually killed by the oil. Perfect kill of aphis was not obtained in our tests even where the oil content was increased to 1½%.

(2). This oil emulsion in combination with arsenate of lead is by no means as satisfactory a spreader for this arsenical as one might expect. It gives a less uniform coating than a good caseinate spreader, but less spotted than arsenate of lead alone. Furthermore, the presence of very much free oil in an emulsion of this type, an ever present possibility, is likely to throw the arsenate of lead out of suspension and result in a very poor protective covering.

(3). As an ovicide for Codling Moth, the oil in this combination was not highly effective, in most cases showing little or no improvement over arsenate of lead alone. Some orchards not under our observation, reported an appreciable improvement in Codling Moth control for this oil-arsenate of lead combination. The comparatively rapid volatility of this oil will possibly furnish an explanation for its ineffectiveness as an ovicide.

(4). Perhaps the worst feature in the use of this dormant oil, during the active growing season, even with only ⅔ of 1% actual oil present,

is its potential ability to cause injury to the fruit by russeting or spotting it, resulting in inferior grade fruit. Numerous growers reported injury to their fruit, involving serious financial loss. This injury to the fruit included especially apples, pears and prunes. In spite of the fact that some growers have used this dormant oil-arsenate of lead combination one or more times the past season without injury, it seems that these are to be complimented for their good fortune, rather than that the practice should be commended. Another cause of considerable loss due to this oil-arsenate of lead combination was from its use in applications for the first cover spray on trees that still retained a residue of lime-sulphur, applied for dormant treatment. This resulted in an unusually heavy drop of young fruit. Investigation has shown that the application of oil spray to growing plants, having residues of sulphur in any form, is almost certain to result injuriously.

A New Summer Oil Spray of Much Promise

During the past season the writer had occasion to test out a highly refined, colorless oil emulsion to determine its effectiveness for the control of San Jose Scale in mid-summer and as an ovicide for the Codling Moth. This emulsion contained 83% of the colorless oil. Of late years the San Jose Scale has become an exceedingly injurious pest in the Yakima and Wenatchee, Wash., fruit districts. Many growers who make the ordinary dormant treatment for this pest, either because of improper application or otherwise, fail to get control and find scale blemishes appearing on their fruit in mid-summer. Such a condition has been practically hopeless. The grower either has to take a heavy loss because of scale marked fruit at harvest time, or adopts the alternative plan of applying lime-sulphur or some material, which, if used at sufficient strength to be of value in controlling scale, is almost certain to seriously injure the crop as well.

A Summer Scalecide

It was with the end in view of developing a safe and effective summer scalecide that this colorless oil emulsion was tested, and with remarkably gratifying results. Tests were made at from 1 to 5% on apples and at from 1 to 4% on pears, peaches, prunes and cherries, in all cases with foliage and fruit on the trees. The main features indicated by these tests are as follows:—

(1). This oil spray at 4% offers a safe and effective substitute for dormant lime-sulphur or dormant spray oil. It can be applied with safety at this strength up to the time the blooms begin to open. (*Note.*

Care should be taken not to apply an oil spray earlier than the time for the second cover spray on trees with a residue of lime-sulphur from the dormant application.)

(2). Control of scale should be attempted before the fruit becomes infested, which usually takes place early in June. On apples control becomes extremely difficult after the young migrate to the fruit, because of the habit of these young scales of locating in the stem and calyx ends, where it is hard to reach them with the spray.

(3). After the fruit becomes infested, two applications, the first at 2½% and the second three to four weeks later at 1½% to 2% strength, appear to give better results than a single application of higher percentage.

(4). Scale blemishes on the fruit clear up rather slowly after the scale has been killed; more rapidly with rapid growing or coloring fruit, but usually it requires from one to two months for these blemishes to completely disappear.

(5). The spraying of over a hundred acres of commercial orchard at Yakima and Wenatchee with this colorless oil emulsion clearly demonstrated the practicability of mid-summer control of San Jose Scale. Some growers who sprayed with this oil packed out from 95 to 99% scale free fruit, whereas neighbors, with about the same degree of infestation originally, lost half their crop.

(6). There appear to be two broods of San Jose Scale in the Northwest, the young of the first brood appearing in June and those of the second late in July and early August. The aim should be to make the first application about two weeks after the first young appear and the second three to four weeks later, thus covering the greater part of the reproductive period of the brood.

(7). Applications of higher percentages (3% or more) of this oil spray during intensely hot weather are likely to be accompanied by some unfavorable reactions, such as retarded sizing and coloring of the fruit. Applications at 4% and 5%, about the middle of June and during moderately warm weather, showed a reaction later of this nature, but there was no burned foliage or fruit. Similar applications during intensely hot weather in July (over 100°F. in the shade) resulted in considerable foliage injury but not very much injury to the fruit.

(8). Pears, peaches, prunes and cherries appear less likely than apples to react unfavorably to applications of higher percentages. An application at 4% to peaches, pears, prunes and cherries in July, during very

hot weather resulted in no apparent injury to trees or fruit. Such an application, however, is not to be recommended.

(9). Trees in a thrifty condition and well watered are less likely to react unfavorably than trees weakened from any cause.

An Ovicide for Codling Moth

The Wenatchee district reported a loss to their fruit crop this year, due to Codling Moth, of over one million dollars. The main complaint seems to have been that the arsenate of lead was not effective. When it is understood that the majority of growers in this district use only 4 pounds of arsenate of lead to the 200 gal. tank, and some spray none too thoroughly or frequently, the reason is not difficult to find for a good portion of this loss. Numerous cases of excellent control have been seen in this same district by the writer the past season, but in these orchards more arsenate of lead was used, namely 6 lbs. in 200 gals. of water, and applications were timely and thoroughly made.

For some years there has been expressed a want for a safe and effective ovicide for Codling Moth, something that would kill the eggs before they hatched and prevent "stings," and at the same time not injure trees or fruit. Tests with this colorless oil emulsion the past season indicate that such a material has been found. It was not possible in the limited time to determine the lowest strength that would give effective ovicidal action, but it is believed that 1 to 1½% would be satisfactory. This spray combines with arsenate of lead readily. As the aim should be to eliminate as much of the first brood as possible, it would seem advisable, where ovidical action is desired, to combine such an oil spray with the usual amount of arsenate of lead in the cover sprays, or as soon as it is known that the eggs are being deposited.

Results the past season in the use of this colorless oil spray have been rather astounding. The writer has observed on more than one occasion from 4 to 6 dead eggs of the Codling Moth on an oil sprayed apple and not a single "sting." It seems probable also that this oil has a residual repellent effect, which keeps the moths from laying their eggs, this repellent action lasting from several days to several weeks, somewhat in direct proportion to the percentage of oil used. One grower who made a single 3% application in July for scale and made no further applications of arsenate of lead, reported considerable less Codling Moth injury to the fruit on the oil sprayed block, when the fruit was sorted, than in the adjoining tract which had received no oil but several additional applications of the arsenical. Another grower who made a single 3% application in July, reported that it cost him only about half

as much to sort the fruit from the oil sprayed portion of his orchard as that which received only arsenate of lead. It was convincingly demonstrated also that late season "stings," a source of much annoyance and financial loss, could be prevented by applications of this oil spray. Incidentally, it might be mentioned that applications at 1 to 1½% gave excellent control of Red Spider on apples, prunes and cherries.

Mr. Leroy Childs, of the Hood River Branch Experiment Station, Hood River, Oregon, reported at the June, 1925, meetings of the Pacific Branch of this Society on the results of tests with an oil ovicide as an auxiliary in controlling Codling Moth. His tests were confined to the first brood and the oil used apparently showed neither the effectiveness nor the margin of safety exhibited by this colorless oil emulsion.

The future of oil sprays in the Northwest is somewhat problematical. It is believed by many that these sprays will gradually take a well deserved place in the spray program and that the present attitude of hostility, brought about primarily through over-enthusiasm, will eventually be replaced by confidence. This optimistic attitude was recently expressed by the Commissioner of Horticulture for the State of Washington, who said that he believed that oil spray was eventually going to be the spray for orchard pest control. A favorable sentiment was expressed at the December, 1925, meetings of the Washington State Horticultural Society. It is undeniable that oil spray has a field of usefulness at present duplicated by no other insecticide and remarkable possibilities seem to be opening up for the satisfactory control of pests heretofore extremely difficult to combat effectively. On the other hand it is certain that if this position for oil sprays is to be attained, it can be reached only through careful research and the education of the spraying public in dependable practices. Nothing destroys the confidence of the fruit grower so much as advice based upon impression, guesswork or half tests, the kind that rarely works out in practice. Here, by all means, the wisdom of "making haste slowly" seems to apply.

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Mr. J. J. Davis: I should like to ask if the difficulties encountered are entirely due to improper emulsification.

MR. W. S. REGAN: That appears to be the main reason. There are probably a number of factors that enter into this difficulty. First of all, we have very hard water; the caseinate is extremely variable and the mechanical procedure differs with different individuals. In other words, the home-made caseinate oil emulsion is very far from being fool proof. The intelligent grower can use it with a fair degree of safety, but he doesn't know at all whether he is using too much emulsion at first. There are some technical details there that the average person knows very little about.

I think probably this line of investigation will come to the front rapidly, that is, the effect the insecticidal agent has upon the oil, how much of the emulsifier to use, what kind to use, and the repellent feature.

MR. J. J. DAVIS: How does the white oil avoid this difficulty?

MR. W. S. REGAN: The white oil is free from the so-called hydrocarbon. These injurious properties have been removed.

MR. J. M. SWAINE: I should like to ask if they have the same results in Wenatchee.

MR. W. S. REGAN: In 1924 the Wenatchee district used oil almost entirely and the same serious reaction occurred. This year there was no oil used in the Wenatchee district—all lime sulphur. I hardly believe there is a carload of commercial oil sold in the Wenatchee district.

MR. J. M. SWAINE: In British Columbia we use a good deal of commercial oil, but no home-made.

MR. W. S. REGAN: That is quite true of the Hood River Valley. I attribute the home difficulty to inexperience and the sudden introduction of the home-made caseinate oil emulsion.

MR. G. M. LIST: I might say in Colorado we have had very serious injury from these oils. We have been doing quite a little work with ovicides for the codling moth and the growers became very enthusiastic about it against our recommendation and in accordance with the recommendation of certain oil companies. We had some entire losses of crops where they were spraying. They were getting very good results in some of the higher altitudes, but in the Grande Valley where the insect was the worst the chemical injury was the highest and we had most of the severe burning there. We got this burning from some three or four brands of crude oils and from oil emulsions made up from a number of the lubricating oils that were on the market.

I might say that we got some very remarkable results from these oils as an ovicide; if the oil can be secured and have the same results as an

ovicide and can be used, I believe it will have a place in our codling moth control in certain applications.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by J. S. Houser.

THE CARE OF SAMPLES USED IN SCORING THE RESULTS OF DORMANT SPRAYS FOR THE SAN JOSE SCALE

By J. S. HOUSER, *Wooster, Ohio*

ABSTRACT

Moisture, natural or artificial apparently plumps dead San Jose scale, *Aspidiotus perniciosus*, and thus may vitiate records by misleading investigators as to the percentage of live scale.

On July 3, 1925 sample branches of apple infested with San Jose scale, *Aspidiotus perniciosus*, were taken from trees which had been sprayed April 7, 1925 with dry lime sulphur. These branches were cut in four inch sections and after having been wrapped in damp newspaper were placed in a vasculum can such as is used by botanists. The can was kept closed until the morning of July 6 when the material was removed and examinations under a binocular microscope started. To my surprise much of the scale appeared to be alive although a previous examination in June had indicated that 99.6 % of the scale on the twigs was dead. The discrepancy could not be understood. The scale bodies, while slightly darker in color than the fresh bright lemon yellow of normal San Jose, were at the same time plump and juicy and most certainly would have been counted as live scale in the course of regular microscopic examinations and counts. Both young and mature individuals presented the aspect of being alive.

The experience was most disconcerting and while particular care had been taken on the occasion of the official count, yet the thought could not escape me that some error must have been made in taking the samples on one of the two occasions.

The plots were visited again on the afternoon of July 6, 1925 and field examinations with the microscope were made. These yielded out of 300 scales examined only one which was alive and this one individual was in a very protected position.

The thought occurred to me that the old dried, mummied scales had absorbed moisture in the damp can and therefore appeared to to be alive, when as a matter of fact they were dead. Another lot of twigs was cut from the tree which had yielded a count of one live scale in 300 and treated as before, i.e., they were wrapped in moist

paper and placed in the vasculum can. Thirty-six hours later microscopic examinations showed many plump, juicy individuals, which, while slightly darker in color certainly could most easily be mistaken for living scale. The same plumping up occurred when the scale bodies were placed in water in a petri dish for a period of 24 hours.

An occurrence slightly varied from the foregoing had been experienced a couple of months before when samples had been taken from a series of scale control plots for microscopic examination. When counts were started the greatest confusion became apparent. Materials of well proven effectiveness apparently were utter failures, for live scale in abundance was found on the material from the whole series of plots. It was so absolutely apparent something radical was amiss that the entire lot of samples was discarded and new material collected. The resulting counts from this fresh lot were, in the case of such materials as liquid lime sulphur, Scalecide etc., in keeping with the experience of previous years. On that occasion we missed the clue, for the taking of the first lot of samples had been preceded by a period of rainy, muggy weather.

It would seem from the foregoing that particular note should be taken with regard to moisture conditions in taking scale records. From this experience the writer has determined to make future counts in the field and only from absolutely fresh material and that these counts should not be made immediately following a rain.

One wonders if this factor, which so far as the writer is aware is not mentioned in the literature on scale control, might not be responsible for the conflicting findings of some of the workers in this group.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by E. D. Ball.

THE LIFE HISTORIES OF TWO LEAFHOPPERS, A STUDY IN ADAPTATION

By E. D. BALL

ABSTRACT

A contribution to the life histories of two leaf hoppers, *Alebra albostriella* and *Erythroneura maculata*, illustrating the adaptability of the species.

Soon after his arrival in Washington the writer's attention was attracted to a group of Japanese Maples on the Mall that were being seriously whitened and defoliated by swarms of *Alebra albostriella* Fall., an introduced species commonly found on Hickory. The remarkable thing about this outbreak was that the damage had been done

in June at about the time that most leafhoppers are just starting their development for the year. About two months later, in August and September, equally large swarms of *Erythroneura maculata* Gill. were found on the Sycamores of the Washington streets. The leaves were badly whitened and dropping just as they had dropped from the Maples and a Purple Beech under the *Alebra* attack of two months before. What caused the striking difference in the time of abundance and damage was a puzzle which the writer tried to solve by as careful a study of the life histories and general biology of the two species as his many other duties would permit

Observations were made during parts of four years. One of these years (1925) had an exceptionally early spring; one (1924) a rather late one, while the other two were fairly normal. The life-histories as presented in the chart are therefore averages and probably about right for a normal season.

Alebra albostriella Fall. passes the winter in the egg stage. The eggs are deposited in twigs varying in size from that of a slate pencil to that of a lead pencil or occasionally larger. The great majority of the eggs are placed in the thickened bark of the nodes. They are placed singly in longitudinal slits. These oftentimes form an almost complete circle about the twig, at other times they will be found distributed along the upper face of the branch. Under normal conditions the eggs all hatch at about the same time, usually following a shower. If however the air is cold and the sun warm those on the southeast exposures hatch first.

The first little white nymphs appear late in April soon after the leaves unfold. By the time the leaves are half grown the nymphs are swarming on the under sides and white spotting is appearing on the upper surfaces. The nymphs take a little less than a month to mature and the adults appear late in May and are swarming by the middle of June. Egg laying begins early in June and by the middle of July it has been completed and the adults have disappeared. The warm moist atmosphere following a shower appears to stimulate egg laying. These eggs remain in the bark for ten months or more, hatching in early May of the next year.

Erythroneura maculata Gill. hibernates as an adult and appears on the Sycamore leaves early in May, a week or two after the leaves unfold. Egg laying has not been observed but in related species the eggs are deposited in the under side of the leaves. The first pale nymphs begin to appear late in May, increasing in numbers through June and

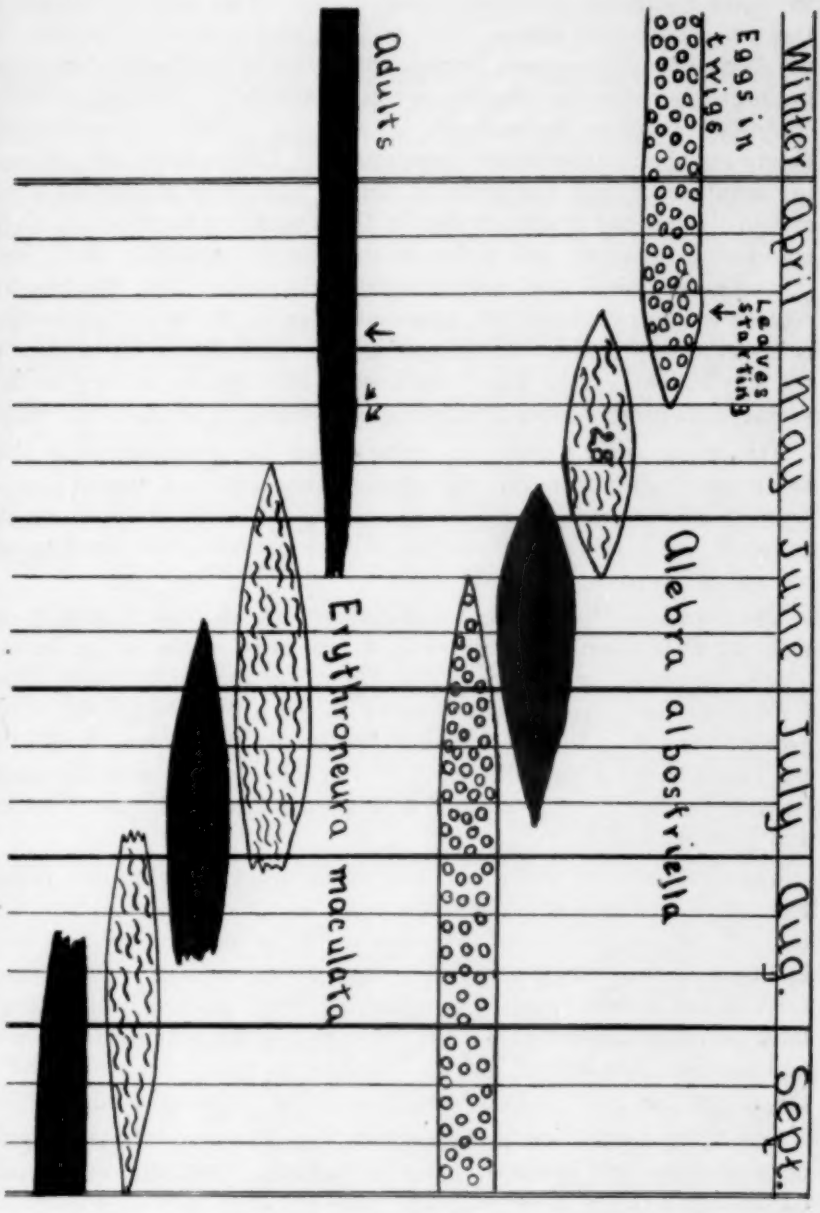

Fig. 1.—Life history chart of two leaf hoppers.

most of July, then gradually decreasing through August and September to finally disappear with the falling leaves. The first few adults of the new generation appear late in June and gradually increase in numbers through July and August, from then on gradually disappearing into hibernation as the leaves whiten and fall. Without carefully controlled breeding experiments it was not possible to accurately determine the relation of the generations in the continuously increasing numbers of both nymphs and adults. Previous studies at Ames and in Boston had indicated that in these latitudes there was a single complete generation, with a few of the earliest appearing adults producing a very small and partial second generation. The Washington records indicate that for that temperature range the second generation is larger but probably not complete. A series of careful studies of the life history of the grape leafhopper have shown a very similar variation between the more northern and southern limits of its range.

The details of this study are unimportant however, except as they bring out the fundamental principle that the number of annual generations of a leafhopper are not determined by the length of the season but rather by some specific adaptation to some period in the development of its host plant.

The Japanese Maple, Beech and Hickory are all trees that push out most of their seasons leaf cover in a few early weeks in the spring. The single annual generation of the *Alebra* has apparantly been pushed forward to the extreme limit in order to place the nymphs on tender growing leaves. They appear with the leaves and mature soon after the leaves have reached their growth. In fact in some seriously infested trees the leaves never reached their normal size but began to whiten and fall instead.

The Sycamore on the other hand continues to develop new foliage through a long period. The leafhoppers however do not at any time feed on the younger leaves but upon the more mature ones that have lost most of the fuzzy coating from their under surfaces. The generations of the *Erythroneura* have apparently been pushed back into the later period of the summer when there will be an abundance of older and more mature foliage just as definitely as the single generation of the *Alebra* has been pushed forward into the period of tender foliage.

One other adaptation is significant, the *Alebra* spends ten months or more of the year in the egg stage in the bark. These eggs are deposited through a period of six weeks or more but they have all reached the

same stage of development and only wait the warm moist condition of the early spring to burst forth and attack the tender foliage.

In the *Erythroneura* at least ten months of the year are passed in the adult stage and in many cases this is prolonged into twelve or more. The overwintering females appear late in the spring and lay eggs through at least a two month period, the first generation adults do not begin to lay eggs for some time after they emerge and use up another six weeks before they are through, all of which serves Nature's purpose of delaying the time of abundance until the time of mature foliage.

ACTING PRESIDENT R. N. CHAPMAN: This concludes the reading of the papers which were scheduled to appear this morning. We will now pass to the first group of papers under the general title "Insects Affecting Cereal, Forage and Field Crops." The first paper is by Herbert Osborn.

NOTES ON THE ECONOMIC STATUS OF CERTAIN CUBAN HOMOPTERA

By HERBERT OSBORN, *Columbus, Ohio*

ABSTRACT

Biological and economic notes on a number of Cuban Homoptera.

During the past winter I had an opportunity in connection with the Tropical Plant Research Foundation to make a survey of the Homopterous fauna of Cuba with more especial reference to association with the sugar cane crop but with no restriction as to localities or crops concerned. I am greatly indebted to the Foundation for many courtesies extended on the trip as also to the Cuba Sugar Club and to the officers at a number of the Centrals where I was given the best facilities possible to render my work effective and agreeable.

It is well known of course that the Cuban sugar crop is a very large one, the most important of any for the island and a major source of supply for the American market. Any destructive agencies are therefore worthy of attention as a factor in the cost of the sugar crop.

My collections were made at many different points on the island ranging from the extreme eastern end to near the west end but were most extended in the eastern central part where some of the most extensive plantations are located. They were directed primarily toward securing the species of homoptera that occur on cane and upon grasses associated with cane, especially such species as migrate readily from cane to grass or the reverse, since the grasses are quite evidently the native

hosts for many of the species that are found on cane and may serve as the hosts to plant diseases such as mosaic.

A complete list of the species secured with distributional notes will appear in another article and I wish here to present in brief form some of the distinctly economic phases of the survey.

As in other tropical regions the homoptera constitute a very conspicuous feature of the insect fauna and while the species in Cuba are perhaps much fewer in number than in Central or South America there are many species that are represented by an enormous number of individuals so that they must constitute a great drain upon the crops attacked. The economic importance of these species cannot be questioned even if we consider only the effects of their feeding upon the plants which are their natural hosts. However the relation which they may bear to the transmission of plant disesaes which has been determined for a number of species has emphasized their importance and it is in this connection that they are receiving particular attention at the present time. For this reason it is of special importance to determine the host plants and the extent of migration as well as the possible limit of hosts for the species that occur in grasses and cane.

It is of course impossible to say what species may serve as carriers for plant diseases and only extended experiment with varying conditions will warrant positive conclusions. The species so far connected with transmission are too seldom found on cane to justify the conclusion that they are the only species capable of serving as vectors while on the other hand extended tests with species that would seem well adapted, have resulted negatively. It seems clear that further tests, with all possible approach to natural conditions, should be carried on so as to determine as certainly as possible which species are responsible for spread of mosaic.

While cane pests claim first attention this crop is not the only one to suffer. The species affecting cane directly or having it as primary host are comparatively few and considered simply as cane feeding species might be considered generally as almost negligible for this crop in Cuba. The West Indian Cane leaf hopper, *Stenocranus saccharivora*, and the cane arrow leaf hopper are the only species found in all stages on cane in such numbers and under such conditions as to indicate that they are permanent feeders on this crop or mainly dependent on it for subsistance and growth. The Cane leaf hopper, *perkinsiella*, once so destructive in Hawaii is not known in Cuba and with careful attention to imported "seed" probably may be permanently excluded.

However, many species living by preference on other crops make

frequent attacks upon sugar cane and should be treated as potential sources of loss even if not directly responsible for the dissemination of cane diseases.

The grass crop is probably the most universally infested with leaf hoppers and while damage to grasses is usually overlooked it should be remembered that mosaic occurring on grasses is likely to be widely distributed by homopterous insects and that hosts of leaf hoppers feeding normally on grasses will scatter widely, especially to more succulent plants if the grasses from prolonged drouth are excessively drained and lose their attraction as host plants.

Of the distinctly grass feeding species *Cicadella similis*, *Draeculacephala sagittifera*, and *reticulata*, *Xerophloea viridis*, *Deltocephalus flavicosta* and *sonorae*, *Euscelis obscurinervis* and *Chlorotettix viridius* are of primary importance but many other species occur in such numbers as to cause extensive loss. Sweet potatoes, an important Cuban crop are largely infested with *Empoasca fabae* and many garden crops suffer infestation, some noticeable instances being *Protalebra braziliensis* on carrots and *Cicadula maidis* on corn.

Cicadella similis (Walk.)

This species is a well-known and widely distributed tropical and sub-tropical form and one which occurs on a wide range of food plants including many of the grasses and it was taken at practically every station where collections were made and especially from Parana and Guinea grass but also in numbers from sugar cane and many species of grasses as well as upon various garden plants. It has been recorded from numerous host plants and recognized as of economic importance but experiments have failed to show that it is a carrier of mosaic of sugar cane. Its economic status so far as known lies in the fact that it is capable of extensive injury to various crops, especially those belonging to the grass family. Considering its very general distribution and wide range of food plants it may be considered as a possible agent in the dissemination of various plant diseases under favorable conditions. It is found in Florida and may extend its distribution, but so far as present observation goes it seems to be confined to tropical and sub-tropical areas.

Draeculacephala sagittifera (Uhler)

This species was found in abundance in nearly all stations in Cuba and it is of known distribution in many of the West Indian Islands. It is very nearly related to *reticulata*, a species which has become quite

destructive to various crops in the southern states. This species occurs particularly on Bermuda grass but is found commonly on other species of grasses and frequently in close association with sugar cane. Bermuda grass is in all probability the favored host and quite certainly one of the species upon which it may pass the nymphal stages. It has not been noted commonly on sugar cane and has not been credited with the transmission of any of the diseases, although it would seem a possible carrier especially for such diseases as might affect the different species of grass on which it may occur. It might in this way be an agent in the extension of plant diseases and in this way of greater economic importance. Simply as a feeder upon grass; it must be counted a distinctly important species since it occurs in such abundance as to act as a severe drain upon the affected plants.

Draecelacephala mollipes (Say)

Our very common *mollipes* is also an abundant and widely distributed species in Cuba and occupies a very similar position, both ecologic and economic, since it occurs on a number of different grasses especially upon Parana and the coarser grasses of the "savannas." It was not observed on cane and considering its distribution is perhaps not a very probable carrier of cane diseases although it might easily serve as such for the different grasses on which it occurs.

Xerophloea viridis (Fabr.)

This species has a very remarkable distribution, having been recorded all the way from Argentina northward through the tropics and temperate North America as far as to the northern United States. It is a very common species on grasses affecting a large number of species and in Cuba it was taken at practically all localities where collections were made. It was not, however, taken in great numbers but, of course, might be more abundant at other seasons of the year. Considering its wide range of food plants and common occurrence amongst the grasses and weeds in and around the cane fields it would seem to be a quite possible agent in the transmission of plant diseases. Although it has not been proven to have such a relationship it may, perhaps, best be looked upon as a species which should receive attention and possible extended experimentation in order to determine its status.

Deltocephalus flavicosta (Stal)

This species in another widely distributed form occurring throughout tropical and sub-tropical regions both north and south, being known as

far as northern United States and south to Argentina. It is very abundant in meadows, and fields of grasses and on account of its abundance must be counted an economic species. In Cuba it was taken in the cane fields and on grasses, and also on cane but very abundantly in the grasses bordering the cane fields. Aside from its injury to the crop directly it would seem to be quite open to suspicion as one of the species that might easily transmit the mosaic disease common to grasses and cane.

Euscelis obscurinervis (Stal)

Stal described this species from Brazil and it was later described as *exitiosa* by Uhler from specimens that had been collected in the Carolinas and credited with serious injury to grain crops. This is, probably, a species of South American origin which has migrated northward and covered practically all of tropical and sub-tropical America. It was found very abundantly in Cuba especially in Bermuda grass and various mixed grasses and in different stages of development, throughout the winter. It is another of the species which occurs abundantly in the grass lands adjacent to the cane but was not observed upon cane itself and it is doubtful whether it will attack cane unless possibly in the adult stage. It would hardly seem as liable to transmit disease as some of the other species although it has abundant opportunity to distribute diseases amongst the different grasses on which it occurs.

Euscelis obtusus (Van D.)

This species was not taken in great abundance in my collecting although it is probably more abundant at other seasons of the year and it was frequently so abundant in the southern United States as to cause injury to crops that it must be looked upon as a probable detrimental species in the Islands. No specimens were taken directly from cane but it seems to occur on quite a variety of grasses.

Euscelis bicolor (Van D.)

Similar to the preceding species in habit, occurring on a variety of grasses in an abundant form throughout the large range of the tropical and sub-tropical area. It has not been found in cane but very commonly in grasses and mixed vegetation adjacent to cane fields.

Thamnotettix colonus (Uhl.)

This is one of the very abundant species having a very wide distribution in the West Indies and southern United States. It occurs commonly on Bermuda grass and *Paspalum* and probably feeds on a

number of other species. Distinctly important as a pest of grasses but not observed commonly in cane or as yet connected with any of the plant diseases.

Chlorotettix viridus (Van D.)

One of the most common species throughout the West Indies and southern United States occurring northward as far as Ohio and probably having its distribution from a tropical center. Its most frequent habitat is in grass and it is undoubtedly a grass feeder and was taken quite commonly in grasses adjacent to cane but seldom on the cane itself.

Cicadula maidis De Long

This species was described from Porto Rico but collected in large numbers on corn at Jobabo, all stages being observed during January and February. Wolcott recorded it from carrots and sugar cane and while corn is evidently the normal host at least for the nymphs, it would seem to be a possible carrier for plant diseases and may deserve experimentation with reference to cane mosaic.

Eugnathodus guajanae De Long

This species has a very interesting habit, occurring in the heads of sugar cane in different stages so that cane would seem to be one of its preferred host plants, but it was taken also in heads of grass "rabozora" and is also mentioned as growing in Parana grass. It has not been connected with any plant disease but considering its preference for cane it would seem a very possible carrier for cane diseases and it would seem important that any diseases of the nature of mosaic should be excluded from its range. Dr. Orton informs me that a disease similar to mosaic occurring in Africa is transmitted by a species of Balcultha and considering the very close relationship to this species it would seem very important that no plants carrying such a disease should be introduced into sugar cane territory.

Empoasca fabae (Harr.)

Our common potato leaf hopper was abundant on various crops, especially sweet potato and the status of the species, so well known in connection with the transmission of potato tip burn, may assume considerable importance where sweet potatoes are planted largely as a border crop to cane.

Oliarius franciscanus (Stal)

This species is known throughout a very large range of the United States and southward to include the West Indies and Mexico and it has

been taken in abundance from grasses and is quite common in cane fields so that it may be counted one of the species of economic importance. It has not been determined to have any relationship to the transmission of plant diseases, but considering its variety of host plants it is quite possible that it might be important in this connection.

Peregrinus maidis (Ashm.)

This species was described as a pest of corn and has been found to occur in a very large distribution having been recognized in Hawaii, Ceylon, South Africa, Porto Rico, and other tropical regions as well as from the southern states where it was first observed. It is not common on cane but it has been determined that it can transmit mosaic from corn to corn and it is, therefore, a possible source of infection for sugar cane. Aside from this possible relation to plant disease, it is abundant enough to be at times a distinct pest for corn.

Stenocranus saccharivora (Westw.)

The common West Indian cane leaf hopper has been known for many years as a cane feeding insect and since it breeds upon this it is to be considered as definitely a cane insect. However, it occurs on grasses and in the adult stage at least may be found on other plants widely separated from cane, although, I think, no records of serious damage to other crops have been reported. While not determined as a carrier of mosaic disease the fact that it migrates from cane to grass and grass to cane would seem to make it a possible menace in this direction and it is certainly worthy of careful investigation from this standpoint.

Liburnia teapae (Fowl.)

This is a very small species of leaf hopper and one which occurs throughout a very large range and affects a great variety of plants, especially of the grass family. For the smaller species of hoppers it is perhaps one of the forms most likely to be connected with the transfer of diseases as it appears to migrate readily from one plant to another and its abundance is sufficient to furnish a large opportunity for dissemination of plant disease.

Tomaspis bicincta (Say)

One of the very abundant tropical species of frog hoppers and reported in a number of cases as occurring upon sugar cane. It may be found frequently upon grasses and evidently feeds quite promiscuously at least upon different members of the grass family so that it might

very readily serve as a carrier of diseases. It is one of the species which deserves close observation and experiment to determine its relation in this manner.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by H. H. Knight.

ON THE DISTRIBUTION AND HOST PLANTS OF THE COTTON FLEA-HOPPER (*PSALLUS SERIATUS* REUTER) HEMIPTERA, MIRIDAE

By HARRY H. KNIGHT, *Iowa State College, Ames*

ABSTRACT

The natural hosts of the cotton flea-hopper are various species of Croton, especially *C. texensis*. The distribution of the insect and a description are given.

In recent years a small Mirid, *Psallus seriatus* (Reuter), has been recognized as causing considerable injury to the cotton plant in Texas and other southern states. Hunter has given a brief account (JOUR. EC. ENT., xvii, 1924, p. 604) of serious injury to cotton caused by this insect in south Texas. Other workers have reported the same type of injury to cotton in Mississippi, Georgia, and South Carolina. Since very little is known as yet regarding this insect I take occasion to record the natural host plant of the bug, which serves no doubt to perpetuate the species in the cotton states and supply infestations to the cotton fields. The natural food plants of this bug appear to be the different species of Croton, especially *Croton texensis* (Klotzsch). I have found it breeding on this plant in Arizona, Colorado, and Missouri, and judging by records of specimens examined the distribution of the bug coincides largely with the natural distribution of this host. Croton grows commonly on waste lands, particularly dry sandy soils, and the bug is usually found breeding where ever the plant is making new growth following rains.

I have examined specimens of *Psallus seriatus* (Reuter) from the following localities: ARIZONA — Texas Pass to Tucson, July 20-22, 1917 (H.H.Knight), on Croton, Tucson, May 24, 1924 (A.A.Nichol), on Croton. Sierrita Mts.,alt. 4000ft.,Aug. 19, 1924 (A.A.Nichol), on *Croton corymbulosus*. COLORADO — Las Animas, Aug. 6, 1925; Hudson, Aug. 25, 1925 (H.H.Knight), on *Croton texensis*. FLORIDA—Dunedin, April 10, 1923 (W.S.Blatchley). ILLINOIS—Meredosia, Aug. 19, 1913 (C.A.Hart), KANSAS—Topeka, Sept. 3, on *Croton capitatus*. MINNESOTA—Jordan, Aug. 1, 1922 (Wm.E.Hoffmann). MISSOURI—Hollister, July 22, 1915

(H. H. Knight), on *Croton texensis*. MISSISSIPPI—Greenville, July 14, 1925 (on cotton), Leland, July 13, 1925 (D.W.Grimes), on cotton. NEBRASKA—Halsey, Aug. 29, 1924 (R.W.Dawson). TEXAS—Cotulla, April 15, 1906. Rock Island, June 9–July 1, 1922 (Grace O. Wiley). Victoria, July 25, 1902 (W.E.Hinds); July, 23, 1916 (J.D. Mitchell), on Cotton. Van Duzee (Cat. Hemip., 1917) also records *seriatus* (Reut.) from Maryland, District of Columbia, New Mexico, Utah, and California.

More recently I have determined specimens of *Psallus seriatus* (Reut.) as follows: CALIFORNIA—Mountains near Claremont (C. F. Baker). LOUISIANA—Tallulah, Oct. 1, 1925 (J. W. Folsom) on *Croton capitatus*. TEXAS—Dallas, Aug. 15, 1917 (E. L. Diven). Brownsville, April and May, 1925, on *Monarda citridora;* May 28, 1925, on *Croton lindheimerianus;* June and July, 1925, on *Gauva coccinea;* Oct. 5, 1925, on *Tidestromia lanuginosa;* Sept. 9, 1925, on *Croton texensis*, all collected by T. C. Barber. Brownsville, Sept. 22, 1925, on *Croton texensis* (R. H. Painter). Port Lavaca, Aug. 21, 1925, on *Croton monanthogynus;* Sept. 10, 1925, on *Croton punctatus;* Sept. 1, 1925, on *Croton engelmannii;* Sept. 10, 1925, on *Croton lindheimerianus;* Sept. 8, 1925, collected at light; Sept. 1, 1925, on cotton, all collected by R. H. Painter. A large series of specimens was taken on each of these host plants.

As an aid in the recognition of *Psallus seriatus* (Reut.) the following description of the adult is added:

FEMALE. Length 3.4 mm., width 1.4 mm. Pale greenish white, tinged with yellowish about calli and front of head, also a longitudinal yellowish line on middle of propleura, sometimes obsolete; dorsum clothed with fuscous pubescence, a small fuscous point at base of each hair, hemelytra with a few larger fuscous dots from which arise a group of deciduous, silvery, scale-like pubescence, but usually absent on imperfect specimens. Antennae pale, segment I with two or three subapical black points from which arise black bristle-like hairs; segment II with five or six black spots, some of which form narrow annulations; segment III fuscous at base. Rostrum blackish at apex, extending slightly beyond posterior margins of hind coxae. Hemelytra with a black spot on apex of corium at membrane margin; membrane dusky, veins white, a small triangular black spot just behind apex of cuneus, and behind this a much larger clear area. Femora with fuscous dots on apical half of anterior aspect, also a small group of dots on subapical area of posterior aspect, hind femora with a row of five or six black bristles on dorsal margin, each arising from a fuscous point; tarsi fuscous at apex.

Male very similar to the female in pubescence and coloration, although the second antennal segment is distinctly thicker.

MR. W. E. HINDS: I should like to ask Dr. Knight whether he has any records from Louisiana.

MR. H. H. KNIGHT: I haven't.

MR. W. E. HINDS: I hope you never will have.

MR. H. H. KNIGHT: I am afraid it occurs on both sides of you.

ACTING PRESIDENT R. N. CHAPMAN: The next is a paper by Dwight Isely.

EARLY SUMMER DISPERSION OF THE BOLL WEEVIL*

By DWIGHT ISELY, *Department of Entomology, Arkansas Agricultural Experiment Station, University of Arkansas*

ABSTRACT

The dispersion of the cotton boll weevil, *Anthonomus grandis*, within a field after the hibernating weevils have become established is periodic. Each period of dispersion coincides with the emergence of a new brood of weevils. The spread of weevils across a field is usually direct from plant to plant or row to row and is not the result of long flights. Newly emerged weevils do not usually migrate until sexual maturity is attained. This information has been used in locating infestations at the beginning of the second and third periods of dispersion and in timing dust applications. Small infested areas dusted before weevils reached sexual maturity resulted in apparent extermination of infestation.

INTRODUCTION

The most frequent difficulties encountered in dusting to control the cotton boll weevil in Arkansas are in locating early infestations, and in making dust applications when they will be most effective. Areas infested by the overwintering brood are usually small. It is difficult to find them until they are marked by flared and fallen squares, which are in evidence after the period of greatest activity of the overwintering weevils is past. If a planter dusts at this time it will be in the interval between the activity of the overwintering brood and the first brood. If he waits for the second period of infestation and again depends upon flared squares as indicators of the weevil's activity, it may again escape notice until the weevils have spread extensively. Because of these difficulties, a study has been made of the spread of weevils within a field after they had once become established in it.

Elaborate studies[1] have been made of the dispersal of weevils from hibernation quarters to cotton fields. Relatively little attention has been given to the spread of weevils within a field after they have become established and before the late summer dispersion. It was the

*Research Paper No. 32, Journal Series, University of Arkansas.

[1]HUNTER, W. D. and HINDS, W. E.—1905.—The Mexican Cotton Boll Weevil. U. S. Bur. Ent. Bul. 51, p. 108–114.

HUNTER, W. D. and PIERCE, W. D.—1911.— The Mexican Cotton Boll Weevil. U. S. Bur. Ent. Bul. 114, p. 85–90.

purpose of the experiments, to be described in this paper, to secure information regarding the manner and rate of spread of weevils and to determine the correlation, if any, of periods of spread with seasonal history. Incidentally, there was opportunity to study the activity of newly transformed weevils. The investigations were begun in 1924 and continued throughout 1925.

This study of summer dispersion of the boll weevil involved the weekly mapping of selected fields, marking the infested parts of these fields. In this way the extent, rate, and manner of spread was recorded. These field studies were conducted on plantations in the Arkansas and St. Francis river bottoms, both in 1924 and 1925. In addition, two small plots on the station farm at Fayetteville were used in 1925. In a way the work at Fayetteville resembled laboratory conditions, since the plots were artificially infested, and as these fields are not in the cotton belt they were not affected by weevils flying in from other fields. Closer observation was also possible than was practical on plantations. In addition to the field studies, cage studies of seasonal history were undertaken in 1924 at Marianna.

The spread of weevils during 1924 and 1925 was periodic, not gradual. These periods of spread could be correlated with seasonal history.[2] After hibernating weevils were located in a field there was little movement. The beginning of the first period of dispersion was coincident with the beginning of the maturity of first brood weevils. The second period was coincident with the maturity of second brood weevils. Between these periods of spread there was a period of little injury. About 50 to 60 days elapsed after first feeding by hibernating weevils and before the second period of dispersion. Following this, weevils generally became so abundant that all cotton was infested.

In all fields under observation the spread of the boll weevil was direct across cotton fields from plant to plant or row to row. All midsummer infestations could be traced to the place where overwintering weevils had settled. When not crowded for food, weevils had a tendency to crawl from plant to plant rather than to move by flight. Long flights were the exception.

Newly transformed weevils were relatively sedentary and fed on the nearest available squares, even when crowded, until they had attained

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[2]HUNTER, W. D. and HINDS, W. E.—1905.—The Mexican Cotton Boll Weevil. U. S. Bur. Ent. Bul. 51, p. 114.

LEIBY, R. W. and HARRIS, J. A.—1924.—Habits and Control of the Cotton Boll Weevil in North Carolina. N. C. Dept. Agr. Bul., March, 1924, p. 8-9.

sexual maturity,—a period of about a week. Following this they began to move from plant to plant, even when isolated and food was abundant.

Relation to Control

More experimental work will be required to determine the extent to which this knowledge of dispersal may be applied to remedial measures. However this information was applied in dusting operations on a few plantations, apparently with the following advantages.

The difficulty in locating areas infested by the overwintering weevils during the period of their greatest activity has been mentioned. However, these infestations are easily located after the injured squares begin to flare and fall, although this may be too late for effective dusting against weevils of the overwintering brood. When the areas infested by the overwintering brood were marked and kept under observation, it was easy to note the earliest activity of the first weevils to develop in the field. In a similar way, it was possible to note the beginning of activity of the second brood.

The relatively long non-migratory feeding period of newly transformed weevils, approximately a week, gives ample time for making dust applications not only before weevils have spread but before they have begun reproducing. Small infestations, both at Marianna and Varner, dusted at this time, were apparently exterminated.

After weevils had begun to spread dusting the infested areas and near by cotton not only was of value in reducing injury on the areas treated, but in protecting adjacent cotton. Even during the late summer dispersal, the migration of weevils has been delayed by dust barriers during the past two seasons. As for example on a part of a plantation near Marianna, dusting operations almost totally prevented the spread of weevils in August, while on another part of the same plantation where dusting was not undertaken until eight days later, weevil infestations had progressed approximately a mile during that period.

Dust applications regulated by following seasonal history and dispersal of the boll weevil require small machinery and relatively little labor and material, in comparison with large scale dusting. For this reason, it may be practical on farms and plantations where large scale operations are impossible. It places emphasis on early dusting rather than late dusting. However it is not expected that early dusting, as just described, will replace large scale operations when general infestations occur, although it may delay and in some cases remove the necessity of general dusting operations.

MR. W. E. HINDS: Mr. Chairman, I think that Professor Isely has done a piece of work that many of us who have been working with boll weevil for a long time have felt the need of. The observations that he has made regarding the control of the overwintered weevils before their offspring become abundant is certainly of value. I believe, however, that he will find there is a large degree of control of the reproduction by overwintered weevils, even when the dusting begins. Those weevils continue their egg laying through a period averaging something like six weeks, so you have a period of about a month in the latter part of the reproduction that is cut off by that dusting, even beginning after those squares begin to fall, but it is exceedingly important to watch those spots where the early infestation occurs. Experience, I think, shows also that those spots heavily infested one year are likely to be heavily infested the next year and are to be watched in a corresponding way.

I am very glad indeed that he has done this work. I hope it can be carried to a point where it may be correlated with the development of the cotton, where the farmer himself can see the conditions and apply that dusting very promptly. I think it is a very helpful piece of work.

MR. G. G. BECKER: I have watched, more or less, the development of Mr. Isely's work in Arkansas and I think his paper is a very significant one. I don't know how it is in other states. The way the boll weevil behaves under varying climatic conditions is a very interesting subject. I know in Arkansas hundreds of tons of arsenate of lead have absolutely been wasted in controlling the boll weevil.

Dusting, considered from the standpoint of the planter in Arkansas, up to the present at any rate, has been nothing short of a dismal failure. They just don't get their money's worth out of it and very few of them know much about when, where or how to dust.

This matter of using the flared squares resulting from the overwintering generation as a marker in effect for confining your early dusting operations is the crux of the whole problem, instead of doing what we have heretofore, making cross sections of immense fields and at a time when that infestation reaches 15%, dusting that immense field.

The present recommendation is in effect to use this little area which has been delineated by the flared squares of the overwintering generation and then get in there and clean that up before the first generation develops.

I saw some of Mr. Isely's curves showing this spread. They are most instructive. I am sorry he couldn't have shown those to the Association.

MR. A. W. MORRILL: I have had a little experience during the past summer along the line of Mr. Isely's experiments which may be of interest. During 1924 in the Mexico Acme Valley there were only 100 acres of cotton. The boll weevil was so abundant that I estimated the loss amounted to one-third of a bale per acre. Nevertheless, we were so successful in controlling it that we made as much out of our cotton with the boll weevil as Arizona and California cotton growers made without the insect to contend with.

The interesting experience I was about to mention is the absolute eradication of the overwintering weevil during the past season, so that cotton grown even beside the old field and cotton grown within one and two and three miles did not become infested at all during the past season, although climatic conditions were very much more favorable for the development of it than in 1924.

This eradication was accomplished by using volunteer plants in the old 1924 field as traps. Those came up very luxuriantly, and in order to reduce the labor involved, we cut those down to about 10%, then we followed the weevil up by plant to plant inspection and applied calcium arsenate with small hand dusters about once a week, so that during the month of June, instead of having the normal increase which we know from past experience would have been very rapid, we had a gradual decrease, and by the first of July we had them apparently so nearly eradicated that we were unable to find a single specimen, even though we searched hour after hour.

The final conclusion of our work was that the weevil did not show up in any of our cultivated fields during the season, except in one field which was nearest to some wild cotton plants growing in a Mexican town about three or four miles away. That was very evidently a case of migration in the latter part of August, so we considered our experimental work in attempting to eradicate the overwintering weevils was very successful.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by W. E. Hinds.

PROGRESS IN COTTON BOLL WEEVIL CONTROL

By W. E. HINDS, *Entomologist, La. Experiment Station*

ABSTRACT

The remarkable progress in control of the Mexican Cotton Boll Weevil, ***Anthonomus grandis***, has been marked with, and is partly due to the thorough cooperation of all agencies concerned. The United States Department of Agriculture, Bureau of Entomology, and the state Experiment Stations have made their experimental results known with the aid of the Cotton Production Council, Extension Workers, and County agents; the Army Air Service and Manufacturers of Dusting Machinery

and Insecticides have contributed materially by improving methods of application and materials; and the cotton growers, having been convinced of the value of the control methods, have generally adopted the recommendations, and have been benefited thereby.

The safe and dependable program for cotton production and weevil control provides a sound basis for the establishment of a permanent system of agriculture for the Cotton Belt, involving the continued production of cotton on a more economical basis and the assurance of a fair profit to the grower, and more reasonable prices of cotton products for the consumer.

It is probable that dusting by airplane will become an important method of control in the immediate future. It has given excellent results in trials, and is sound and economical from a business viewpoint.

As the Mexican cotton boll weevil, *Anthonomus grandis*, has spread over practically the entire Cotton Belt, it has become from a financial standpoint, the most important economic entomological problem in the United States, and probably in the entire world. The loss in cotton yield ranging from 20 to 40% of normal production as a rule, has meant the complete destruction of from 2 to 5 million bales of cotton annually. This decrease has been the main factor in reducing our national crop to a point barely above one-half of the world production and our position of dominance in cotton production has been threatened.

With the world production shrinking to below the world's demands for cotton, the price of lint has been soaring from some 6 to 8 cents per pound before 1915 to from 25 to 40 cents per pound since that time. Under these conditions the heavy burden of boll weevil damage has been transferred from the producer to the consumer of cotton primarily. The prices of cotton goods, and other cotton products have advanced proportionately. As a result the cotton consumer has been paying in recent years a "boll weevil tax" amounting to not less than $10.00 per person for our more than 100,000,000 population, or more than $1,000,000,000 annual tribute to this "Mexican Bandit," "Billy Boll Weevil."

The problem of controlling this important insect has been under definite and continuous study since 1902. Steady progress has been made but at no time has more important progress been made than during the last few years. One of the most important elements in this progress has been cooperation. Cooperation was established first between the Federal and State entomologists working on the problem. This was brought about largely through the conferences held by The Association of Cotton States Entomologists, who have for years made the boll weevil the principal subject on their programs. A number of years ago the Cotton States Entomologists affiliated with the As-

sociation of Southern Agricultural Workers as a Section thereof. This brought about a closer cooperation with the Agronomists, Pathologists and Plant Breeders.

This close cooperation led to the appointment of a special Committee on Cotton Production which in the fall of 1923 toured the southeastern states and studied the outstanding investigational work in progress in the fields and arranged to bring together the results of the season's work in time for a general report at the annual meetings in January following. The outcome of this effort was found to be exceedingly beneficial. There was formed The Cotton Production Council. Through it, for the first time, it was possible to formulate and adopt a simple, general "Program of Recommendations for Cotton Production Under Boll Weevil Conditions" which was adapted to the entire Cotton Belt and which met with practically unanimous approval by all of the workers and leaders concerned. Wide publicity was then given to these "Recommendations" with all workers emphasizing the same practices. Following this lead, further cooperation has been arranged whereby substantial agreement has been reached as to important experimental methods, the keeping of records, the study of many important problems calling for further experimentation and in reporting through a central agency (Mr. B. R. Coad, of the Delta Boll Weevil Laboratory, Tallulah, La.) important information as to weevil population to enter hibernation in the fall and the emergence of weevils from hibernation occurring in the spring. This "advance information" as to the conditions that are likely to occur in various sections of the Cotton Belt is exceedingly helpful.

Three general recommendations which had grown out of the early work done under the comparatively dry climatic conditions of Texas, and which had gained wide-spread popular acceptation in other sections also, had to be changed materially in the light of later investigations under other climatic and soil conditions, and especially because of the development of effective methods of artificial control. These ideas were "wide spacing," "very early planting" and the use of "small-bolled," extra early maturing varieties.

The second very important element in cooperation consisted of the enlistment of the Agricultural Extension Workers. The entomologists were able to sell their program to the County Agents on a general scale only when they came before them with substantially uniform recommendations for all sections. The Agents then sold the program to the cotton farmers very generally and now many thousands of

"cotton demonstrations" are conducted annually reaching all parts of the Cotton Belt, especially in the more heavily weevil infested sections. Today as a result, there is a general acceptance of the recommendations for "moderately early planting," with rows as close together as they can be worked, and plants averaging less than a foot apart in the row, using improved seed of varieties having medium-sized bolls, and with a good length of lint, and using fertilizers increasingly on practically all soil types to increase the yielding capacity greatly. As a result yields of from one to three bales per acre are being produced in spite of potentially heavy weevil infestation. It is common to save by dusting more than half as much cotton as is produced without dusting and at a very great increase in the margin of profit secured from the crop. Increased yields per acre mean decreased cost of production per pound and an increased profit whatever the market price may be.

Thus the cotton program consists of two sections: First, the cultural methods for increasing yielding capacity, and second, the practice of the most effective known methods for weevil repression. The direct weevil control measures include a study of the weevil population in the field before squares form and the control of these weevils before they have deposited any eggs. Then the proportion of squares attacked by the weevils emerging later, or escaping the pre-square poisoning, is watched closely and the regular dusting program is started when 10% show weevil punctures. The dusting is continued at intervals of four or five days until the weevils are well under control and until a practically full crop of cotton has been set and the bolls have developed to a stage of maturity that makes them practically safe from further weevil attack. Prompt picking should then be followed by the complete destruction of all green cotton as early in the fall as this can be accomplished. Such is a brief outline of an effective cotton production and weevil control program.

The present methods for insecticidal control of the boll weevil have been developed during the past fifteen years especially. First Dr. Wilmon Newell showed in Louisiana that the weevil could be quite fully controlled by dusting the cotton plants with arsenate of lead. Then Mr. B. R. Coad brought out the present calcium arsenate dusting method about 1918 and steady progress has been made since in the improvement of the poison, especially in its physical properties and in the standardization of its manufacture. Even more conspicuous has been the progress in the manufacture of dusting machinery. Various

types of hand and traction driven machines have been produced and widely used. These are all of the fan type and have been designed to meet the widely varying conditions existing as to acreage in cotton, ground conditions, labor supply available, etc. Many difficulties and problems have arisen with each of these types of machine. All seemed entirely too slow, difficult to operate, exasperating to the labor supply and generally, utterly inadequate to the immense task of poisoning some 20,000,000 acres of cotton that seems to call for protection to make a profit in cotton production possible.

Then in 1922 a faint speck appeared above the cotton entomologist's horizon. It was not a cloud, or a passing bird, but was an approaching human invention—an airplane. Of what possible use could an airplane be to a cotton farmer? No one knew, but some one had a vision and decided to find out. So an airplane was tested out first as an insecticide distributing machine for the control of the catalpa sphinx in Ohio. The worms disappeared so immediately and completely that many entomologists were frankly skeptical as to the responsibility therefor of the airplane distributed dust. Soon after this, however, arrangements were made whereby the Army Air Service detailed a few old army planes to Tallulah, La. for experimental work under Mr. Coad's direction to see if they could be adapted to the difficult problem of boll weevil control. It was soon found that the airplane could be so used, and that weevil control from airplane dusting was fully equal to, and often superior to that obtained with the use of ground machines. A great, new field of usefulness for airplanes appeared to be a possibility.

Consequently by 1924 one of the large airplane manufacturing companies (the Huff-Daland Aero Corporation) became interested and sent competent men to Tallulah to study the work being done there and the type of airplane best suited thereto. As a result an entirely new type of plane was designed and built for dusting. The maneuverability of the planes was greatly improved, their lifting capacity increased and the pilot safe-guarded in avoiding trees or other obstructions and in making landings. The type of poison hopper and method of dust discharge was worked out carefully to secure the finest possible separation of the poison particles so that the cotton could be covered most thoroughly with a mimimum dosage of calcium arsenate. It was found that one-third of the usual dosage of poison could be saved where airplanes were used. The pilots became exceedingly skillful in flying their machines from only fifteen to twenty-five feet above the cotton tops,

according to the air conditions and the spread of the dust cloud. As a rule they cover a swath 200 to 250 feet wide and as they pass over the cotton at a speed of about 100 miles per hour, they are actually dusting an acre in less than two (2) seconds. Actual coverage of more than 500 acres per hour can be obtained under favorable conditions, and one machine can protect 5000 acres or more of cotton. The airplane can cover the field most completely so that not a leaf can be found that does not show some trace of the poison on it. It operates in daytime and does effective work under conditions which prohibit the use of all other types of machines.

It is not surprising therefore that by the fall of 1924 someone got the idea of organizing a commercial airplane dusting service. It was apparent that this service could be offered to the cotton planters at a cost that would not exceed that required for them to provide their own machinery and poison supplies and do the work themselves in a much less pleasant and satisfactory way. The pioneer organization in this field was organized in the fall of 1924 under the name of "The Huff-Daland Dusters, Inc.," and they proceeded at once with the construction of a considerable number of planes and prepared to offer a commercial dusting service to cotton planters in 1925.

In developing the plans for this service, they have cooperated very closely and constantly with the technical workers, adopted unhesitatingly the program of dusting recommended, and have incorporated in their contract many provisions suggested by the entomologists for insuring the most reliable and effective service possible and for safe-guarding the planter against the making of any un-needed applications, or financial loss in case the service should not be needed at all after the contract had been signed. The interests of the dusters in caring for necessary overhead expenses, and even assurance of a continuous and adequate supply of poison seems to have been properly cared for in this undertaking, in case the service is not called for after a dusting unit had been arranged for during the season. The cost to the planter is put upon an "acre-application" basis, with three applications as the minimum for the acreage put under contract, but the planter may distribute the total acre-applications contracted for upon any portion of the area where the weevil infestation may make it seem most desirable, and any portion may be left with no treatment whatever, if such treatment is not needed. Additional acre-applications may be secured by the contractor at any time during the season for the original acreage and at a very reasonable cost therefor. If the weevils are controlled by hot dry weather, or if for

any reason whatever, the planter does not use all of the applications for which he paid at the beginning of the season, then he may receive a refund therefor at the end of the season. To assure timely and efficient applications, provision is made for the employment of a disinterested, competent "Entomological Advisor" who keeps in close touch with the weevil infestation conditions, and furnishes copies of this information to both the planter and to the dusters. Upon this advice, available to the planter without any further cost, if he chooses to make use of it, he can make request for dust applications and be assured that they will be applied promptly just when and where they are needed and will not be given after the probability of profit therefrom may have passed.

Thus for the first time, it has been possible for a cooperating group of cotton planters, located in territory suitable for airplane work, located within a radius of ten to fifteen miles from a central landing field, and including together some 4,000 or more acres of cotton needing protection usually, to secure the location of an airplane dusting unit in their midst for the season. This relieves them of the responsibility for most of the provision for machines, poison supply, etc., relieves their labor supply entirely from the disagreeable night work necessary with ground machines on large areas, places the conduct of the work entirely in professional hands and assures the best possible weevil control at an economical cost.

Probably the best thing about this fine new idea is that it works very satisfactorily. During the season of 1925, in Louisiana alone, more than 50,000 acre-applications were made by four units for boll weevil control, beside a vast area covered also for cotton leaf worm control; and similar work has been done in several other cotton growing states. It may be possible to form some fair estimate of the saving from such work when we consider that in the experimental work at Baton Rouge this season, the average of the fourteen poisoned areas gave a yield of 1308½ pounds of seed cotton per acre while the average of nine undusted check areas yielded only 885 pounds. Poisoning added nearly 50% more cotton to the yield secured without dusting. We believe that similarly good results were secured as a rule from the use of the airplanes.

Furthermore, the airplane duster has now demonstrated its usefulness in other important fields also. More than 300,000 peach trees were dusted in Georgia for control of the plum curculio and brown rot. Pecan orchards present a very difficult problem for spraying but may prove to be easily covered with insecticides or fungicides discharged from airplanes. The control of Anopheline larvae by Paris green, diluted greatly

with a dust carrier, has proven to be wonderfully successful, while yet safe for the domestic animals that may drink such treated water and for the fish that may live therein.

In summarizing these statements of progress in weevil control, we believe that a safe and dependable program for cotton production and weevil control has been developed, and has now become firmly established through the most heavily weevil infested area. It provides a sound basis for the establishment of a permanent system of agriculture for the Cotton Belt and makes possible the continued production of cotton on a more economical basis and with reasonable assurance of a fair profit to the progressive farmer with lint and seed selling at prices that will make cotton products more economical to the consumer.

Exceedingly important progress has been made in perfecting insecticidal dusts and improving dusting machinery. These are now available for any other problems in insect control.

Furthermore, the dusting airplane has now become a reliable, standard insecticidal machine with almost endless possibilities in prospect for its usefulness to mankind. It is worth considering also that such extensive development of airplane manufacture and use for beneficent purposes and upon an entirely self-supporting and profitable basis, may easily become the principal factor in developing in this country a large commercial aircraft industry, available for national defense in time of need and of immeasurable benefit to all mankind in time of peace.

Cotton Plant Louse Control

The cotton plant louse (*Aphis gossypii*) occurs throughout the Cotton Belt and is a common pest on other important crops as well as on cotton. It frequently occurs so abundantly in the spring—especially in cool periods—that they stunt the growth and retard development of cotton by at least two weeks—even if they do not completely destroy the stand of plants. Later in the summer they frequently become so abundant as to cause defoliation of the plants.

In the course of poisoning for boll weevil control it has been noted often that there is a direct effect in increasing the plant louse infestation after several applications of calcium arsenate have been made for weevil control. This has been an objection to dusting in the minds of many planters but no practicable method of overcoming the difficulty was known. During the past two seasons the Louisiana Entomologists have been working on this problem and now believe that a simple, practicable and economical method of louse control has been found. The experimental results have been confirmed by some other workers and the prac-

ticability of the recommendations has been demonstrated by quite extensive application in Louisiana during the past season.

Briefly the method consists in making the calcium arsenate dust applied for the boll weevil the carrier for the nicotine sulphate needed to secure louse control. This dust mixture may be made easily on the farm from stock materials and may be applied by the regular cotton dusting machines of any type whenever and wherever the lice become injuriously abundant. Simple and inexpensive, yet effective, home made nicotine dust mixing equipment has been devised so that any required quantity, up to 100 or more pounds, may be prepared for use in less than fifteen minutes time. The formula used consists of 94 parts by weight of Calcium arsenate with six parts of nicotine sulphate (40%) or a ratio of practically one pound of calcium arsenate to one ounce of nicotine sulphate. For this combination of calcium arsenate and nicotine sulphate, in any proportions, we suggest the use of the common name "Calarnic" and that the strength of nicotine therein be indicated by statement of the actual percentage of nicotine used. In our standard formula this would be Calarnic 2.4% nicotine.

The dosage should be from 8 to 9 pounds of Calarnic per acre of cotton. Approximately one-half pound of nicotine sulphate per acre thus applied has given repeatedly better than 98% control of the lice. The expense for louse control is approximately 75c per acre. No hood or other modification of dusting apparatus is needed. The one essential condition to success is that the application be made when the air is practically still. The rate of drift of the dust cloud should not be more than 100 feet per minute. Late afternoon applications are preferable but early morning has also given nearly as good results, even when the plants were wet with dew.

No case of burning of cotton foliage from such applications has come to our knowledge. Such chemical reactions as may occur have not seemed to be dangerous to workmen, mules or plants and have not appeared to decrease the efficiency of the calcium arsenate for boll weevil control or the nicotine sulphate for plant louse control. This dusting method in still air with either calcium arsenate or hydrated lime as a carrier, is far more convenient, rapid and effective than spray applications for louse control on cotton—as also upon several other crops to which we have applied it.

MR. E. C. VAN DYKE: I would like to ask Dr. Hinds what he thinks of the possibilities of using this airplane dusting method for the control of the widely extended and great outbreaks of grasshoppers.

Airplane dusting cotton for boll weevil control at the rate of an acre in two (2) seconds. Photo by Delta Laboratory, U. S. Bureau of Entomology, Tallulah, La.

MR. W. E. HINDS: I believe it can be adapted to that purpose and do an immensely important service; also to other field crop insect problems where we haven't seen the possibility of entering the field in a practical way.

MR. E. C. VAN DYKE: In other words, it would be very adaptable, then, to conditions in the West.

MR. W. E. HINDS: The plain, fairly level or gently rolling country with fairly large fields in one crop subject to general infestation presents a fine field for the airplane.

I might add that the rate of treatment gives you an idea of the capacity because they can treat an acre in less than two seconds and do a better job than we are able to do with any other kind of machine, and also accomplish that result with practically two-thirds the amount of poison that we use with ground machines for boll weevil control.

MR. A. A. GRANOVSKY: In Russia lately they have been using the airplane for dusting against the locust with quite good success, dusting them while the grasshoppers are in the air.

ACTING PRESIDENT R. N. CHAPMAN: The next is a paper by E. G. Kelly.

THE CREOSOTE-CALCIUM CYANIDE CHINCH BUG BARRIER

By E. G. KELLY, *Extension Ent., Kansas*

ABSTRACT

The creosote-calcium-cyanide barrier, an improvement on earlier barriers, was demonstrated most successfully in 30 Kansas counties as an effective check on the chinch bug, *Blissus leucopterus*. Directions are given for the construction and maintenance of the barriers.

The chinch bug (*Blissus leucopterus* Say) has been a pest to wheat, corn, kafir and other grass crops in the United States for many years, and in Kansas probably since the state has been under cultivation. The damage to crops varies with seasonal moisture, especially at harvest time and in mid-August. In Kansas the bugs hibernate in the clump forming grasses that flourish along roadsides and in waste places. The hibernating bugs leave the grass on wing in early spring and fly to wheat fields, or, if the season has been cold and somewhat delayed, they fly to spring planted oats and barley. The bugs feed on wheat, oats and barley and as soon as the weather warms they lay their eggs behind the sheaths of the first leaves or down among the roots. The bugs hatching from these eggs do not become mature before harvest time, therefore the ripening grains force the immature bugs, which have no wings, to crawl to new fields in search of food. Corn, kafir,

cane and other sorghums are about 10 to 20 inches tall at harvest time making suitable food for them and it is these crops that can be protected by the creosote-calcium-cyanide barrier.

Pine tar, gas tar, coal tar, No. 10 road oil, crude oil and other ill smelling materials have been used in making a barrier between wheat and corn to keep chinch bugs out of the corn since as early as 1882. Boards were set on edge and tar poured on the edge with post holes 20 to 30 feet apart along side the boards into which the bugs were trapped and killed by pouring oils upon them. Soil has replaced the boards and recent investigators have replaced the oils with creosote and a poisonous gas known as hydrocyanic acid gas. This gas is generated from calcium cyanide placed in the bottoms of the post holes. The creosote-calcium cyanide barrier as developed by J. W. McColloch at the Kansas Experiment station has proven to be the most efficient and most economical type of barrier for farmers to use. It consists of a smooth furrow at side of field upon which to pour the line of creosote with post holes about 20 to 25 feet apart dug near the creosote line; about one tablespoonful of flake or granular calcium cyanide placed in the bottom of the hole. The bugs will not cross the creosote line, but turn down it only to run into a hole filled with hydrocyanic acid gas.

There were a number of such barriers built in Kansas during the summer of 1924, every one of them giving satisfaction. The news of a successful way to control chinch bugs was spread far and wide, therefore it was not surprising that few farmers were interested in burning bugs during the winter, but on the other hand were ready to build the barrier the following summer.

The bugs were abundant from southern Kansas to the Nebraska line, and quite a way into Nebraska, at flight time in the spring of 1925. Farmers became alarmed and began calling for aid long before the bugs were ready to move from wheat. Thru abundance of publicity most every one kept a close watch of his wheat fields and knew what to do.

The county agents in Kansas were called into conference in late May for the purpose of organization. They were instructed on the methods of building a barrier and arranged for demonstrations in their county. Each of the 41 farm agents called to the conferences arranged to build from one to four demonstration barriers in the county and to get creosote and calcium cyanide for their constituents. In the southeast section of the state, where most trouble was expected, timely, heavy rains eliminated the necessity for building the barriers. However,

Corn fields protected from chinch bugs by the creosote-cyanide barrier.

Corn field on other side of the same wheat field, NOT protected by the barrier.

the larger portion of the infested area remained dry so that the demonstrations were built, and were of great value.

Twenty-nine county agents and one special agent built demonstration barriers in 30 counties, 358 barriers were reported as having been built along the side of 154 miles of corn field. Each mile of barrier protected an average of 320 acres of corn and by comparing with corn fields that were not protected it showed a saving of 250 acres, or a total of about 50,000 acres.

The bugs that were caught at the creosote cyanide line did not disperse to other fields to reproduce the second generation. The bugs that were not caught did reproduce a second generation and during August and early September did as much or more damage to corn, kafir and sudan grass than the first lot did to the corn, therefore, we underestimated the saving and it should be at least 320, acres or more.

According to the reports from county agents from 29 counties there should have been 2490 miles of barriers built. One substantial farmer told me that his failure to build a barrier cost him 40 acres of corn that would have made 75 bushels per acre, a small loss of 3,000 bushels of corn. The longest barrier reported was 3 miles long protecting about 800 acres of corn. This barrier was built and maintained by one man. The barrier was by the road side on a very public road. Dozens of auto loads of people stopped to see if the creosote line actually stopped the bugs. The young man in charge of the line gave out a lot of information on building and maintaining that kind of barrier. One day he had to clean out the post holes, he piled the bugs in heaps, one of them was quite large, so he put up a card stating "Here are a few thousand dead ones." Dozens of people examined the pile to be sure they were chinch bugs.

The creosote-calcium cyanide barrier for controlling chinch bugs is only an improvement on the old barrier, but it is the kind that gets results and that is the kind we want. These materials will be available another year in Kansas; local dealers will be glad to handle them for the results of the barriers built this summer have given the farmers much confidence in the method.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by L. H. Worthley.

A SURVEY OF THE EUROPEAN CORN BORER SITUATION IN 1925

By L. H. WORTHLEY, *Administrator in Corn Borer Control.*

(Withdrawn for publication in a later issue.)

ACTING PRESIDENT R. N. CHAPMAN: The next is a paper by H. G. Crawford.

THE STATUS OF THE EUROPEAN CORN BORER IN ONTARIO (1925)

By H. G. CRAWFORD and L. S. MCLAINE, *Entomological Branch, Ottawa, Canada*

ABSTRACT

During the season of 1925 the European Corn Borer, *Pyrausta nubilalis*, in Ontario extended its range outside the quarantine area of the year (227 townships) by 25 townships. These form two major extensions. One of eleven townships in a north and easterly direction from the main body of the infested area, and a second of fourteen townships, an eastward extension along Lake Ontario and the St. Lawrence River to Brockville. The intensity of the infestation throughout the Province increased in general, though a marked decrease took place in the neighborhood of Union in the centre of what was formerly (1923) the most intensely infested locality. The increase in the Counties of Essex and Kent was most marked, the crop throughout at least 400 square miles was completely ruined. Here average stalk populations by fields reached as high as 39 larvae at the end of the season, and in some fields every cob was infested and 84 per cent of the cobs were seriously checked in their development. The prospects are for continued increase of approximately the same magnitude in 1926. Control measures are being adopted very slowly by the farmers, and promised legislative action is awaited by the growers before they seriously attempt to grapple with the problem.

The situation in respect to the European Corn Borer throughout Ontario in 1925 paralleled very closely the conditions in 1924, both as to abrupt increase in degree of infestation and in the continued spread of the insect into new territory. The only considerable area under observation where definite increase was not the case was in or near the original centre of the severe infestation around Union in Elgin County. In this locality from St. Thomas to Lake Erie (9 miles) the numbers of the insect distinctly decreased. Elsewhere, with the additional exception of the north-west corner of Middlesex County, the borer either held its own numerically or actually increased.

By the autumn of 1924 the total area under quarantine, which includes all the infested townships, and certain uninfested townships included in order to make the quarantine lines reasonably workable, involved 221 townships and an approximate area of 18,180 square miles.[1] In determining the quarantine lines for 1925, 6 townships were added without determination of their infestation status. Thus the 1925 quarantine area covered 227 townships and 18,590 square miles.

[1]McLaine, L. S. and Crawford, H. G. "The Status of the European Corn Borer in Ontario (1924)," Jour. Econ. Ent., 18:95–98, 1925.

The scouting for the season 1925 proved infestation in 25 new townships outside the known general range of the insect and in five townships not formerly known to be infested but within the quarantined area of 1925. This raised the number of townships directly or indirectly involved in the infestation by the autumn of 1925 to 252, and added 1,789 square miles to the territory infested. Eleven of the newly infested townships form a consolidated area of extension of range north and eastward from the main body of the known distribution along the shore of Georgian Bay (Lake Huron) filling in the district between this natural barrier and Lake Simcoe. Here, the insect has reached approximately the northern limit of corn cropping in this part of Ontario. Fourteen of the newly infested townships form a narrow extension of the eastern arm of the infested area, one tier of townships deep, along the north eastern shore of Lake Ontario and down the St. Lawrence River to Brockville including Wolfe Island. This infestation is discontinuous, a gap three townships wide cutting off the three most easterly infested townships from the main body of the infested zone. The five townships found infested within the quarantined area of 1925 form the bulk of the island-like area of Prince Edward County.

Intensity of Infestation

In studying the degree of infestation the observations have of necessity been confined to a count of stalk infestation, a count of the larvae contained being impossible in any but local and intensive studies. This unfortunate circumstance detracts from the value of the record, particularly where the stalks exceed an infestation of 50 per cent. As the infestation increases in intensity the stalk counts reflect less and less exactly the probable larval population as the number of the larvae per unit increases much more rapidly than the percentage of stalks infested would suggest. In spite of this limitation the records throughout the districts examined reflect very fairly the true situation, and as they have been made in a uniform manner and in the same localities from year to year, are directly comparable.

Comparing the 1925 conditions with those of 1924 by general districts, the records indicate that the infestation along a semicircular line of observation points seven miles from Union as a centre (Circle No. 1), decreased from an average of 53 per cent of stalks infested in 1924 to but 40 per cent of stalks infested in 1925. Along a similar line of observation points (Circle No. 2) fifteen miles from Union no change was noted in the infestation, the record for both years being 32 per cent. At a distance of 30 miles from this common centre, however, (Circle No.

3) the infestation increased from 7 per cent in 1924 to 11 per cent in 1925. In the three series 240 fields were under observation. Throughout the rest of the area studied it was found that the infestation had increased, with the exception of the observation points in Oxford County, where the infestation remained at 3 per cent and in the north western part of Middlesex County where it dropped from 6 per cent in 1924 to 3 per cent in 1925. The increases from 1924 to 1925 were for Norfolk County, an increase from 2 per cent to 9 per cent; Lambton County from 3 per cent to 5 per cent; Huron County from 1 per cent to 4 per cent; Lincoln County from .04 per cent to 1.16 per cent; Welland County from 2 per cent to 11 per cent; Haldimand County from 1 per cent to 3 per cent; Kent County from 24 per cent to 52 per cent and in Essex County from 13 per cent in 1924 to 37 per cent in 1925. It should be remembered that these are not county averages but merely averages of from 10 to 45 fields per county taken in a uniform manner in the same localities from year to year. General observations in Prince Edward County also indicate a very rapid increase of infestation, though no definite counts were made.

As was expected the most striking increase in intensity and extension of the area of economic loss occurred in the Counties of Essex and Kent in the heart of the grain corn growing area. Along the north and south line between these two counties the corn throughout an area of at least 400 square miles was completely ruined as a farm crop. Economic losses and severe infestation extended out from this area for from 6 to 10 miles in all directions, decreasing in intensity as the distance from the local centre of damage increased. The stalk infestation counts in the severely infested area give no adequate idea of the severity of the damage. Some idea, however, can be formed of this situation in the severely infested district from the summarized detail of a study of 18 corn fields in a block made at a point 2 miles north of Coatsworth, Romney township. This group of fields was selected in the early season as representing a series of planting dates ranging from May 12th to June 23rd. The average stalk infestation by the end of the season proved to be 98 per cent, with a larval population per stalk by fields which varied from 2 to 37, and averaged for the whole 18 fields 18 larvae per stalk. This average larval population was associated with a cob infestation of 75 per cent, a shank infestation of 58 per cent with 38 per cent of the stalks broken above the ear and 15 per cent of the stalks broken below the cob. One of the worst of the fields, however, with a stalk population of 34 larvae, had all the cobs infested, 78 per cent of the

cobs checked in their development due clearly to the presence of the borer, 94 per cent of the shanks infested, 84 per cent of the stalks broken above the ear at some point other than the tassel, and 33 per cent of the stalks broken below the ear. The crop was, of course, utterly useless and a most striking example of the possibilities of this insect under normal grain corn culture.

The conditions in the canning corn area are not so acute, as the crop is grown largely in areas where such high intensities have not yet been attained. Infested cobs, however, have been increasingly noticeable at several canneries and presently will form an acute problem.

There is little prospect in 1926 of any marked change in the situation and an additional increase in the intensity of the general infestation is feared. The control of the pest it is felt could be accomplished by the general application of the cleanup method. The practices involved, however, are being adopted very slowly by the farmers, partly through general inertia, partly on account of the work involved and the change in general farm practice, partly on account of the feeling that the insect will disappear like the army worm, but chiefly on account of the lack of confidence in the possibility of the neighbours co-operating. The general tendency has been to wait for official action and such official action is likely to be taken by the Province of Ontario during the winter of 1926. Definite legislation is in prospect requiring that corn in the severely infested districts be grown only under enforced clean-up conditions.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by J. R. Parker.

THE INFLUENCE OF TEMPERATURE UPON THE AMOUNT OF FOOD CONSUMED AND THE NUMBER OF EGGS LAID BY GRASSHOPPERS

By J. R. PARKER, *Bozeman, Mont.*

(Withdrawn for publication elsewhere)

MR. R. C. SMITH: I should like to ask Mr. Parker if that difference in number of molts is characteristic of all these individuals in each of the lots.

MR. J. R. PARKER: In every case.

MR. R. C. SMITH: Have you any explanation for that?

MR. J. R. PARKER: Possibly at the higher temperatures development was so fast that they didn't have time for these other molts. If we look upon moltings as getting rid of body waste and if we have them over a long period, we might need more molts to get rid of the wastes that have accumulated in the epidermis.

MR. G. A. DEAN: I would like to ask Dr. Parker how the number of eggs in the pods or capsules compares with the number of eggs found in the capsules of the females under normal conditions.

MR. J. R. PARKER; It was practically the same. The average for *atlanis* was about 25. Even at the end of the egg laying period of the one that laid 15, they laid two right toward the end that averaged 26 and 27. They varied sometimes down to 10 or 12, but the average for those that laid a high number of egg pods was not very much lower than those that laid only a few.

MR. G. I. REEVES: I have some facts that tend to confirm the number of molts. In an early paper on the alfalfa weevil, the observers were not entirely in accord as to the number of larval stages. One observer noticed in 1912 that while the usual number of larval stages in the alfalfa weevil is three during the summer season, in specimens he reared during the early and late parts of the summer, that is, during cooler temperatures, there were four larval stages.

Then in the matter of relation of temperature to egg laying, we have made observations which bear out very strongly the principles stated by Mr. Parker as to the control of oviposition by temperature. We are beginning to believe that it is only in years which have abnormally warm Aprils that we have weevil damage in the state of Utah. In Salt Lake County there has been only one such year since 1919; that was the year just passed (1925). We have had only one serious weevil attack in Salt Lake County since 1919, although there have been others elsewhere.

MR. G. A. DEAN: Since in my opinion Mr. Parker is one of the best authorities we have on the biology of grasshoppers, I should like to know if he would care to express any opinion as to what is the difference between *atlanis* and the old Rocky Mountain grasshopper, *spretus*.

MR. J. R. PARKER: That is a question that I have decided half a dozen times and then changed my mind. A good many of us have noticed the work of the Europeans. They have definitely proved that *migratorius* and another grasshopper that I forget the name of which have been considered different species are really one and the same, and that out of the species there developed some migratory phase which to all

observations is an entirely different grasshopper, the migratory phase having longer wings. I think the same relation holds true between *atlanis* and *spretus*.

It is my opinion that *spretus*, from the few old specimens I have seen, is nothing but a migratory phase of *atlanis*, and the fact that out of a few specimens collected during the last recent outbreaks, Green and Hubbard have determined some of them as *spretus* and you can't tell them from *atlanis* makes me think that is true. I have been trying to produce this experimentally. I thought at first the temperature might be a factor. I am working now on the influence of food. I found that grasshoppers fed on green succulent food have shorter wings and generally are not as husky as the ones given concentrated food, and I have got some increase in wing length by feeding them dried alfalfa leaves along with the green food.

MR. G. M. LIST: Mr. Chairman, I should like to state that we have found the relation of temperatures one of the most important factors in the number of eggs deposited by the codling moth and we believe that is one of the most important factors in making the insect much more serious in some sections than in others. I have made some counts in the ovaries of the codling moth, finding that they ranged, as far as I could count them, from 300 to 340. Under what we consider almost ideal conditions for the codling moth, where we have had so much trouble, we had a total of 316 eggs deposited by a single female, showing that they have reached almost their maximum in egg production, and in our cage records we find they are running much higher in the Grande Valley, Colorado, for instance, than they are in the cage records taken in other altitudes where the temperature is the most important factor, and in comparing these with the records taken in the other sections we find the same correlation.

MR. E. D. BALL: We have in the western country a large number of leafhoppers with wings so short as to be incapable of flight. These leafhoppers produce at the very beginning of their period of emergence small numbers of long winged forms. These long winged forms immediately fly away and thus serve to distribute the species to other localities and prevent its extermination in times of drought. This phenomenon seems to be most highly developed in the arid areas in the Western country and would almost exactly coincide with the regions in which the old maps show that the *spretus* form was developed. Attention has already been called to this relationship in an address that was abstracted in the Journal of the Washington Academy of Sciences.

It seems to me, as was suggested in this address, that it is in this form of adaptation that we should look for the explanation of the development of the long winged *spretus* form of *M. atlanis* following periods of extreme drought in the Rocky Mountain region while following a series of normal or wet years they would disappear. This is further supported by the fact that while *M. atlanis* occurs over a large area in the United States it is only in the arid regoins of the West that the *spretus* form has ever been produced.

MR. H. B. JOHNSTON: I was recently in correspondence with Mr. Uvarov of the British Museum, and he, I believe, in the Caspain region made certain important experiments with various entomologists on the variations between *Locusta migratorius* and *L. danica*. I think there are certain structural variations between these two. I believe they have proved they are produced by altered conditions in the breeding. We tried to reproduce those experiments and we found by taking larvae of Locusta and overcrowding them in breeding cages, we were able to produce forms approximating *Locusta migratorius*. What the overcrowding means, whether it is lack of food or raising of temperature, I don't know and I don't think the researchers know at present.

I just wanted to mention that overcrowding factor in reference to Dr. Parker's paper.

ADJOURNMENT: 12:40 p. m.

Section of Apiculture

Wednesday Morning Session, December 30, 1925

The meeting was called to order at ten o'clock in the Kansas City School of Law by the Chairman, Dr. R. L. Webster.

CHAIRMAN R. L. WEBSTER: I will ask Mr. Frank Pellett to occupy the Chair while I give my report.

(Mr. Frank C. Pellett assumed the Chair.)

CHAIRMAN F. C. PELLETT: The first paper will be given by Dr. Webster.

RESEARCH IN APICULTURE

By R. L. WEBSTER, *Fargo, North Dakota*

The present group which I have the honor to address was first formally organized in December 1911 at Washington, D. C., and was known as the Association of Official Apiary Inspectors of the United States and Canada. At the Cleveland meeting of the Association of Economic Entomologists in 1912 it was made a section of that organ-

ization, which was known as that of Apiary Inspection. Your chairman well remembers some of the discussion regarding this new section that took place in hotel lobbies, in which real opposition was expressed. This opposition fortunately was overcome, and the new branch became an integral part of the larger organization.

In 1917 at the New York meeting there came a change of real importance, indicating a step in advance for beekeeping, and a realization that apiculture as a whole, rather than apiary inspection, was the real field of interest for the majority of those in attendance at these meetings. At that time the Section of Apiary Inspection became the Section on Apiculture.

This shifting of emphasis from apiary inspection to the broader field of apiculture in general was correlated with a greater appreciation of the importance of beekeeping and of the necessity for a better organization of our knowledge of that field. Without question apiary inspection is highly important, even absolutely essential, but all regulatory efforts are handicapped when so little has been accomplished in the field of investigation. Without question much money has been wasted on inspection, and more may be squandered, before we come to a realization that definite principles must be established before great progress can be made. The alcohol-formalin treatment for American foulbrood has wrought great changes in methods, but this means of control, if we are to actually admit the truth of the situation, is one that should have been brought to light long before it was.

Those of us who are working within college walls too often gain the impression that knowledge is confined to institutions of higher learning. Yet no one can deny that the greater portion of the whole of our present knowledge of bee behavior is due to men who have had little or no association with college or university life. Those of you in this room who were fortunate enough to hear Dr. W. M. Wheeler, in his address at the University of Chicago during the meeting in 1920, will readily grasp the full significance of the idea, clothed in far better words than I can phrase it.

Research in apiculture in our colleges and experiment stations is gaining in impetus, tho slowly. Outside of the work done in the Apiculture laboratory at Washington and a half dozen of our experiment stations, little real effort has been experienced in this direction.

As a matter of fact it is usually far easier to obtain funds for demonstration work, or for inspection, than for genuine research. Those things which are, in truth, of relatively less importance, are first given support. What is lost sight of is that it is essential to determine facts. Once

definitely established principles can be laid down, many of our present problems will disappear.

As honey production increases in the United States, beekeepers are likely to find that their own problems will increase. True some of these problems are economic, but none the less are well worth careful study. One needs not go far to obtain advice on the much-discussed question of marketing honey, but where can there be obtained any adequate publication that represents a careful survey of this problem.

It is generally conceded that honey is sold at a margin dangerously close to the cost of production. The producer, then, must either make an attempt to gain more of the margin now taken by the middleman, thru collective bargaining or otherwise, or he must make an effort to lower the cost of production. Our agencies of agricultural research, the federal government and the experiment stations, have then a two-fold responsibility before them. The problem cannot be solved from one angle alone. And more efficient methods of management of bees and marketing of honey will in the long run make it actually profitable, year in and year out, for those who are engaged in that line of activity.

Those states having the foresight to provide funds for investigations in beekeeping, from both these standpoints, are the states most likely to become leaders and to continue as leaders in honey production. Even tho research in apiculture in any state is not likely to develop without corresponding development in demonstration and inspection work, those phases of activity cannot expand unless supplemented by new ideas and new facts; things which will not be forthcoming except by the careful accumulation of data.

At the present time, outside of the United States Department of Agriculture, those experiment stations in which genuine research in apiculture is being accomplished can almost be counted on the fingers of one hand. Others, without question, are taking steps in this direction, but because of the numerous other activities which demand the time of anyone at all interested in beekeeping, these have made little progress.

It requires only a hasty survey of our various station publications to come to the conclusion that station research in apiculture has far to travel. Too many of these publications are merely restatements of what is already known and too many bear the ear marks of hasty preparation and even a lack of fundamental knowledge. In fact, from the point of view of development, apiculture stands about where economic entomology, or rather insect control, stood thirty years ago. But the

further growth is bound to be at a more rapid rate, because of the greater accumulation of facts in allied fields.

On the other hand the research worker must not lose sight of the fact that he is expected to contribute occasionally to the literature of beekeeping. Some of this work has more recently seen light in the columns of our bee journals, but more of it should be published in the shape of station bulletins. All of us should look forward to the time within the next few years that we can observe on the shelves bound volumes of beekeeping investigations from the Kansas station, or the Texas, Iowa or Wisconsin stations.

At the present time articles on the subject of apiculture find space in a large variety of periodicals. Too often, when one desires to consult a paper that has been given at one of these sectional meetings, he is met with the item "Withdrawn for publication elsewhere" and he is at perfect liberty to guess as much as he pleases wherever that may be.

In closing, I want merely to add that those of us who are most interested in beekeeping must look forward to the establishment of some means of publishing technical papers in a journal for that special purpose. The time is probably not yet at hand, and there is no need to add to the number of defunct bee journals, but there is good reason to believe that it will not long be delayed. Long strides have been accomplished during the fifteen years since the beginning of this group of students in beekeeping, yet we expect even greater strides during the coming fifteen years.

CHAIRMAN R. L. WEBSTER: The next paper is by G. H. Vansell.

THE CALIFORNIA BUCKEYE AND ITS RELATION TO THE HIVE BEE

By G. H. VANSELL, *Davis, Calif.*

ABSTRACT

California buckeye (*Aesculus californica* Nuttall) has long been accused by beekeepers in parts of California, of being poisonous to the hive bee, while in other parts it is in high favor as a source of nectar. Products of this species were shown by experimentation to be very detrimental to bees where they feed upon it to the exclusion of other plants by reason of drought, local abundance, or other conditions. Also a grass feeding bug (*Irbisia solani* Heid.) was found to migrate from the drying grass to feed upon the buckeye trees. The exudate from their punctures, which the bees collected, may be a factor in this "buckeye poisoning," but the distribution of the bug and other facts concerning its habits are not well enough known to justify absolute statements.

Beekeepers have long disagreed as to the nectar value of the California buckeye, *Aesculus californica* Nuttall. Some have insisted that bees are

killed by feeding on the nectar from this plant and others are equally insistent that it is a valuable and safe source of nectar. These divergent opinions among honey producers can be readily understood after a study of the problem is made as outlined in this paper. A knowledge of the climatic conditions governing the growth of the buckeye and the peculiar distribution of the plant is fundamental to this understanding.

Sufficient experimental evidence is now available to state definitely that this buckeye is seriously injurious to bees wherever the plant is abundant, during years when for any reason other plants fail to produce enough nectar to be more attractive to the hive bee than the buckeye.

California buckeye is not found over the entire State. It is confined to a foothill zone extending around both sides of the Sacramento and San Joaquin valleys. This zone reaches the ocean at various places from Mendocino County to Ventura County, and it extends eastwardly into the Antelope Valley of Los Angeles County. Its habitat varies in any particular location depending upon the nature of the soil, direction of prevailing winds, the mean temperature, slope exposure, and other factors to such an extent that in some places the trees are to be found only on one side of a canyon or even only in sheltered pockets on one side, while there are two districts in which this species is exceedingly abundant on practically all exposures. One of these latter areas extends from above Three Rivers in Tulare County into Kern County, the other from northern Yolo County southward through Solano and Napa Counties. The distribution of the majority of plants of an arid or semi-arid range is spotted and the distribution of this species is *most* spotted.

The blossoming dates of *Aesculus californica* in different localities vary from April to September; in dry warm areas the length of the blossoming period is something like five weeks, while in cooler areas with moist air conditions the blossoms keep coming on for nearly three months. Where the period is short a great many of the blossom buds abort. Nectar is produced very freely in this species throughout its blossom period and its flow is not affected by annual conditions to anything like the extent observed in shallow rooted plants.

Those who know any of the other species of Aesculus such as the imported horse chestnut present in the eastern United States would immediately recognize *Aesculus californica*. It grows to be a tree of considerable size (40 feet high) in the southern part of its range, but in the north it rarely attains a height of 15 feet. The bark is almost white and quite soft. The leaves drop from the tree early in the season over much

of its distribution area so that in many places it is almost naked by mid-July.

As yet no poisonous chemical substance has been isolated from either buckeye nectar or buckeye honey. (Undoubtedly, however, there is a sufficient amount of poisonous material present to be determined when a process is found for extracting it without destroying its properties.) It seems probable that the material is a glucosid of very unstable nature. The former use of buckeye extract by the Indians for stupifying fish in rivers and lakes was a well known practice and the poisonous nature of the green leaves, twigs, and raw nuts of buckeye to children and livestock has been recorded in many states.

The effects of buckeye pollen, nectar, sap, and honey on bees are sometimes very severe. Not only are the field bees affected, but also the adult queen and drones, as well as all the larvae and emerging young adults. In severe cases the whole colony will become extinct with the hive full of honey. The majority of the larvae being fed are killed outright and are in the main devoured by the adults. Those young which are not killed will pupate and emerge if they are not so badly deformed that they are unable to do so. Bees with but four normal legs are very common and the wings of practically all emerging young never expand. Also many of the adult bees become weakened and die in the hives and are carried out by the survivors to be dumped in front of the entrance in a great pile of dead and dying bees. Many of the deformed bees do not seem to have normal instincts for they will crawl out of the hive and away from it, going toward the sun to the tops of weeds and grass to remain until they die. Again the field bees at times seem to be affected the least of any in the colony possibly due to the facts that they obtain other nectar and thus lessen the effect of the poison, and that they are possibly more resistant than the larvae; however, again, they nearly all become unable to void fecal material and assume the "shaky" attitude of paralytic bees. The queen's egg laying power is cut down to almost nothing, which leads to attempted supersedure; the resulting young queen is often unable to fly or in case she is able to take the mating flight she is unable to lay more than a very small number of eggs.

The many cases in which the effects of buckeye do not become very apparent can be explained in a number of ways. Other things being equal the malady becomes increasingly severe with the greater amount and concentration of the buckeye products brought in from the field. Where other nectar plants are yielding simultaneously the bees are gathering other nectars and pollen which results in dilution and spread-

ing of the effects of the buckeye poison. It has been found that heavy feeding of sugar syrup throughout the buckeye flow, even where other plants are scarce, brings about a reduction of "buckeye poisoning." Where the rainfall is sufficient or the atmosphere sufficiently cool and moist for abundant annual growth of mustard, filaree, bur clover, the sages, etc., the beekeeper is not bothered with this trouble to any extent. Even in an area particularly subject to the effects, when a wet year with abundant late spring rains is experienced the bees do not suffer nearly as much as under the reverse condition. Wherever, for any reason, the buckeye products become increasingly abundant the bees suffer correspondingly.

The terms buckeye nectar, honey, and pollen are not used exclusively in speaking of this malady. This is on account of the fact that in many cases, perhaps in all, the bees actually gather buckeye sap with the nectar and pollen. The small plant bug *Irbisia solani* Heid., a normal grass feeder, migrates to the buckeye trees as the grass dries down. It punctures the leaves, blossom buds and tender twigs of the trees, evidently for food, and from every puncture a droplet of sap exudes. This sap is collected by the hive bees and this trouble may be caused by sap instead of nectar or pollen.

CHAIRMAN R. L. WEBSTER: The next is a paper by F. B. Paddock.

THE CHRONOLOGICAL DISTRIBUTION OF THE BEEMOTH

By F. B. PADDOCK, *Ames, Iowa*

ABSTRACT

The spread of the bee moth, *Galleria mellonella*, over the globe is traced chronologically by countries. The date of introduction is given wherever possible and the distribution with natural restrictions is given.

The honey bee is an insect of very ancient origin for its associations with the civilization of the human race cover 50,000 years according to Wells. We do know that the earliest records made by mankind include references to the honey bee and its importance in their life economy. The problem of the origin of the honey bee is usually solved in an indifferent manner covered by the statement that they followed the spread of the human race over the globe. It is interesting then to picture a possible time in beekeeping when the pest known as the beemoth was not present. At that same time we must ask if the beemoth ever occurred as anything but a pest of the honey bee. Was there a time when the insect had life habits somewhat or entirely different from

what is recorded in beekeeping literature? Or did it appear as a true species and a distinct pest of the honey bee at the same time? The statement is made that the beemoth is wholly of Oriental origin. This must be based on the assumption that the moth was a pest of bees before they were kept by man in his early life even in the Eurphrates valley.

Of the records which are readily available to the writers of antiquity we find that Aristotle of Greece, living B. C. 384–322, recorded in his writings on agricultural subjects the fact that the beemoth was then generally known by beekeepers and considered a serious pest. In Italy we find Virgil B. C. 70–19 in his 4th Georgics mentions the beemoth as the cause for a condition which he described as a brood disease of bees. Again Columella (1–68 A. D.) the Roman authority on agriculture tells of the beemoth as a serious pest in the bee hive. Pliny (23–79 A. D.) the celebrated Roman Naturalist discusses the beemoth in his Natural History as a Papilio.

Linneaus whose system of nature is the foundation of our modern system of classification first (II, 888, 375) referred to the beemoth as *Phalaena mellonella*. The specific name coming from the supposed fact that the food of this species was honey. In his tenth edition (1758) the beemoth is listed as *Tinea mellonella* and he quotes other references to this species by the systematists of that time. In his twelfth edition the beemoth is called *Tinea cereana* which specific name had been applied by other writers of systematic entomology.

Swammerdam in his Bible of Nature which was not published until 1752 altho the work was done from 1673 to 1680 refers to the beemoth as *Tinea mellonella* and calls this commonly known pest of bees the well deserved title of "beewolf." Reaumeur in France listed the beemoth as *Tinea mellonella* Linn. Fabricius in his Systema Entomologiae in 1775 lists the beemoth as *Tinae mellonella* Linn. but in a later edition he introduces the name *cerella* based on the discovery that the food of this species was wax and not honey as had been supposed previously. In his supplement published later he established the Genus *Galleria* to characterize the moth living in bee hives. This genus is well defined today and recognized by systematic workers although the species are very few.

It has been very difficult to make contact in Greece in order to have a survey of the beemoth as it exists today. So no statement can be made relative to the extent of spread and intensity of ravages of the beemoth in Greece in present times. In Italy several reports were made

which indicate the very early occurrence of the beemoth and its general distribution. Reference has been made to the writings of early Roman authors. It seems there are no regions in Italy where bees are kept that the beemoth is not also present.

So far no references have been available to indicate this first appearance of the beemoth in Hungary; the date must be left as one correspondent said "since remotest antiquity" and another wrote "with the beginning of beekeeping." In this country the moth becomes more rare at the high altitudes which are described as the colder parts. In Austria it is reported as having been present "for several centuries" and "known at all times." Here the beemoth seems to be distributed without restrictions. Likewise, in Germany, there seems to be no recorded date for the introduction of the beemoth.

This goes back of any modern literature though the pest was recorded by very early systematic workers. Linnaeus states that the beemoth was not known in Sweden prior to 1750 when it was imported with the bee hives from Germany. In this statement we have an accurate date of the arrival of this pest into Sweden, and also the inference that it was common in Germany at that date. The spread of the beemoth in Sweden is much restricted in the altitudes and it is noticeably a pest only in the costal areas. The early records of this insect in France is by systematic workers referred to above. The spread today seems to be very general even in the more normal altitudes. It is present today with general distribution in Portugal and Spain where it has been known as a pest from earliest times. Contact has not been made with Russian workers so the early history of the beemoth in that country is lacking. One writer says this pest has been known in Russia from a very early date. Publications since 1913 frequently mention this pest of bees so that its distribution must be quite general.

In northern Africa this pest must have been found very early in history but the records have not been available. The beemoth is reported today as not uncommon thruout Egypt. In Tunis the beemoth is generally distributed thruout the country. It has not been possible to secure any data on the introduction of the species into that country.

When the beemoth appeared in England is a matter yet to be established but it must have been at an early date. It is mentioned by all early writers of the period 1780, principally as a pest of old stocks. Recent importation of the Dutch race of bees from Holland had brought in the pest. There is some indication of a correlation in England between the race of bee and altitude with the severity of this pest. In Scotland

the reporters indicate that the beemoth is present but seemingly they are not much as a pest, perhaps this is to be accounted for by climate as it may be made up of factors of temperature, moisture and altitude in terms of barometric pressure.

There is a difference of opinion in regard to the time this insect was introduced into the United States and the origin of such shipment. The year 1805 is given for the first appearance in this country altho the honey bee had been here for more than 150 years. The spread of the moth has been consistent and today it covers the entire country with the possible exception of areas of high altitude in the Rocky mountains.

In Canada the distribution of the beemoth is very interesting. In the eastern provinces the species is present and especially in Ontario where it seems to be most abundant. In Manitoba, the moth has been introduced but does not become established and in British Columbia the insect has not been observed in ten years of inspection work. It seems quite evident that here again the pest is prevented in its spread by climatic conditions.

Records are not available showing the time that the beemoth was introduced into Mexico altho one correspondent mentioned it was "when the first box hive was introduced." The spread seems to have been erratic and apparently higher altitudes are freer than lowlands.

The beemoth is supposed to exist under optimum conditions thruout the temperate zone. Therefore its appearance spread and present distribution on the islands of the West Indies group is interesting. These small bodies of land are considerably isolated but with a moderate amount of commercial exchange. No date for the introduction of the pest is available but the distribution now appears to be general in Cuba, Porto Rico, Santa Domingo, Jamaica and the Virgin Islands.

In South America the beemoth is quite commonly distributed with the probable restrictions indicated by higher altitudes. In British Guiana whenever colonies become weak for any cause the moth is always present to complete the job of destruction. In Brazil the distribution of the beemoth is considered quite general but there does not seem to be any records available as to the time and methods of introduction. The pest is exceedingly severe in Argentine as black bees and poor methods prevail thruout the country. In one area the severe winters serve as a decided check on this insect. In Ecuador there are no records of the presence of the beemoth and very little beekeeping. However, in Chili the insect is prevalent in the Provinces of Valpariso,

Santiago, and Aconcajua, along the coast which means the lower altitudes.

The conditions in South Africa are such that it was considered more timely to take them up at this stage. To us today it seems that the insects in states of the union of South Africa were largely imported in comparatively recent times. Therefore the comment of C. W. Malley are very interesting. He says that the oldest beekeepers remember the beemoth from the days of their youth. It may have been present from time immemorial, even at the time when the civilization of North Africa was not separated as it is today. Definite records were made of the beemoth in 1888. Today its distribution is quite general and on account of the mild winters its ravages extend thruout the year.

Again it is interesting to record the beemoth in an isolated territory, Japan. Here the insect must have been imported and the early record of 1791 is very interesting, earlier than the pest is recorded in United States. Its spread has been such that it is now found over all the island. The native Japanese bees are often destroyed by the moth.

In Manchuria, the beemoth is now spread over all the country. The time of its introduction is most uncertain. There were wild bees in the country at the time of its colonization by the Russians. The records do not show if the moth was present then or not. The present importation of bees from European Russia dates from 1898. The pest is very serious in this country.

In north China no records are available to determine the date when the beemoth was introduced. It has been known as long as modern authorities are familiar. The spread has been general and the damage is severe since the beekeeping methods favor the waxworm. It is considered an ancient pest in South China and today it is the source of great loss among beekeepers, who, of course, use the old methods.

The beemoth is considered a very bad pest of bees in India. Here we find its ravages among *Apis indica* as much as *A. mellifica*. Perhaps the native bee is less active in its warfare against the moth than is the introduced bees. Colonies are so severely attacked that any uncovered comb may become infested. The moth is reported as indigenous to India. In Ceylon the native bee is *A. indica* and it has been subject to the ravages of the beemoth from a very early time. Italian bees introduced on the Island are readily attacked, in fact it is difficult to pursue beekeeping on account of the moth. In Hawaii the moth has been known from the earliest times. It is possible to keep bees clean by per-

sistent effort but lax methods permit the moth to increase to a menacing degree.

The island continent of Australia is interesting because of its recently developed beekeeping. The beemoth is now found in all the states but in varying degree. In Queensland its distribution is general but it is not regarded as a serious pest. The moth was reported from New South Wales about 1872 and spread very rapidly. It is only a pest in neglected apiaries but due to the mild winters it does great injury to stored combs. The moths are great pests of the black bee in Victoria where it is reported there are four generations each year. Italian bees seem to go with modern management and the combination serves to make moth control relatively simple. The earliest record of the moth in South Australia is 1891. The spread has been very rapid and complete so that it is considered a very serious pest. Due to the mild climate combs are severely attacked. The spread of the moth in West Australia is very general being correlated almost entirely with black bees.

The first record of the moth in New Zealand was in 1900 at Egmont. It is believed that this infestation came from Australia. The spread was very rapid, with the aid of careless beekeepers and black bees. In New Zealand the moth is included in the disease apiary act.

In this brief tabloid manner an effort has been made to outline the spread of the beemoth over the globe. The honey bee has been very closely related to the spread of the human race and the beemoth has been a pest of bees from very early times. The trace of the beemoth is closely related to the development of civilization.

MR. T. H. FRISON: I would like to ask Dr. Paddock about his introductory statement regarding the association of the honey bee with men. Did I understand you to say 5000 years?

MR. F. B. PADDOCK: That authority is taken from the Geological Chapter of Wells' Outline of History. The earliest written records that we have are about 4500 and have been handed down from the Euphrates Valley.

MR. T. H. FRISON: We don't have much record of men even at that time and I wondered how we could have much evidence of the honey bee. We might assume if primitive man saw a nest of wild bees and honey, he would become associated with them.

CHAIRMAN R. L. WEBSTER: The next paper is by E. W. Atkins.

HOW TO MARKET HONEY

By E. W. Atkins, *Watertown, Wisc.*

Abstract

There isn't a magic wand to wave that will sell honey at top prices over night. Like every other product a market for it must be built up. Our present system of marketing food products has taken years of time and careful work to develop and as honey is a food product it seems logical to take advantage of this available organization to bring about its distribution.

In order to sell a product there must first be a demand for it. In the history of successful selling it has always fallen to the lot of the manufacturer or the producer to create the demand for his product. When the demand is created the so-called regular channels of trade readily undertake the distribution, if given the right kind of cooperation.

A honey market becomes easily glutted and prices drop precipitately with a good crop, primarily because honey selling as a whole is on an amateur basis.

The problem of marketing honey today as many who have studied the subject see it, is primarily to get honey in a position so that it is more available to the average housewife at prices that the public can be made to believe are comparable with other articles of diet now readily available at moderate prices. It is claimed that the surest and safest way to build up a market for honey is to have it handled through the legitimate channels of trade by men and organizations whose worth and standing is known and, therefore, whose products are accepted by the community because of tacit endorsement.

First, to create a better market for honey we must increase the sales of honey. I am not a native of Wisconsin, but I must admit that Wisconsin has gone farther as a state than most states in the Union in putting honey on the map with the endorsement of the regular channels of trade. According to Dr. S. B. Fracker, of Madison, the primary thing in putting honey on the map is to supply and enforce standards by which honey can be graded and which will accurately describe it.

Every person who is seriously interested in the future of honey sales ought to read that statement several times.

Ezra Warner, President of Sprague, Warner & Company, Chicago, one of the greatest organizations of wholesale grocers in the world, in speaking to the writer about the marketing of honey said: "The primary thing in the sale of any food product is the absolute protection of the customer by the maintenance of quality."

In other words, the first requirement that Wisconsin beekeepers have set up in marketing honey is thoroughly endorsed by one of the

biggest merchandisers of food products in the world. This is particularly interesting because in Wisconsin we market more than 5,000,000 pounds of honey in a year. Mr. Edward Nordman, State Commissioner of Markets, says of the plan now being successfully operated in Wisconsin, "Instead of honey being shipped out of Wisconsin by the carload as formerly, it is now shipped out only in small quantities. The beekeeper takes more care, labels his honey properly, and has increased his trade."

The second standard set up by the Wisconsin association for successful honey marketing is "an attractive container and a label or trademark upon which the public can rely for quality goods."

This follows as the night follows the day in any successful merchandising campaign. None of us walk into the grocery store nowadays and ask for a cake of soap, but usually ask for some specific kind of soap which we have come to know by its label or trademark, such as "Palmolive," "Pears," or "American Family."

Dr. Fracker continues, "The first step toward establishing a standard of quality has already been taken in a grading system and the state grades are printed on the labels. Beekeepers that use the grades can, therefore, guarantee the quality of honey sold under this label, for the grading of honeys under these labels is absolutely enforced by the State Department of Markets."

Naturally the third part of the Wisconsin program stipulates "Advertising and publicity which will remind prospective purchasers of the delightful flavor of honey every day."

In 1924 the firm with which I am connected attempted to find out the status of honey marketing in this country by offering cash prizes for the best ideas put forth by anyone on honey marketing. The campaign brought out quite effectively that there is in this country at the present time no big, constructive program for the sale of honey and that the nearest one to it is the Wisconsin Association. This lacks perhaps only the dignity of a state-wide advertising campaign to put the plan on a plane in Wisconsin with Aunt Jemima's pancake flour, Log Cabin syrups, or any of the other well known and widely advertised food products.

Mr. E. A. Meineke of Chicago very aptly says, "We cannot get very far if we sell a man a jar of honey and he does not use it, for so long as he has that first jar of honey he will not be in the market for more." Perhaps it is fair to say as does John Auckland of Iowa, that "honey production has not been conducted on a *commercial* scale long enough to

become established as a staple food." Note particularly the use of the word commercial in Mr. Auckland's statement.

The peddling of honey would not be such a drawback to the business if it furnished honey regularly and supplied a dependable product. The trouble is that it spoils the larger sale of honey through the regular channels, for when the peddler's supply is gone, people wait in vain for his return and too frequently do not buy any more in the meantime.

Undoubtedly as Mr. Auckland claims, "Honey packages usually make a sad appearance in comparison with those of most of the packaged foods." Also, unfortunately the extracting rooms and packing rooms of too many beekeepers would be sad places to take a prospective customer for an observation of the extraction of honey, as compared to the immaculately clean cow barns of such wonderful plants as the Carnation Milk Company. No one willingly eats dirty food, and while a customer may be inveigled into purchasing a package of food that he afterwards finds out is dirty, it will prejudice him, and most of his friends and relatives, from that time henceforth, against the purchase of the same kind of a product, no matter how cleanly it may be the next time nor how well endorsed it comes.

"Any beekeeper can raise the status of beekeeping in the eyes of the public by improving the appearance of his honey house," according to Miss Anna Klinner of Illinois.

Mr. A. G. Murry of Virginia says, "The proper management of an advertising campaign should include first, an adequate supply of clean, well graded honey."

It is not necessary to dispose of inferior grades of honey to those who intend to use it as a raw food. The use of the dark and inferior grades of honey in the baking and candy industries where it has to be thoroughly sterilized by heat is commonly known.

The use of inferior grades of honey as an anti-freeze mixture in the radiators of automobiles affords an outlet for that kind of honey that undoubtedly at present exceeds production. It is reported that a beekeeper in Iowa recently purchased a carload for that purpose. Perhaps the principal reason why such honey finds its way to the regular markets is because too many beekeepers have not honestly learned the grading of honey and convinced themselves that inferior grades are worth less money. To too many, honey is honey.

On the other hand, the use of good honey for other than food always seems a shame. Honey may make good cosmetics, cough syrups, and corn salves, but it is primarily a good, wholesome food, and the future

of honey sales does not lie in attempting to substitute it for something for which it is not really a substitute.

One of the most widely heralded and so-called authorities on foods has for some years maintained in a New York newspaper that blended honey was an unfair product, should be prohibited by law, and that the innocent purchaser was "skinned" when he purchased blended honey. There is no reason to doubt this man's sincerity, but there is every reason to doubt his good common sense.

Anyone acquainted with honey knows that some localities always produce light colored honey and others darker honey. Anyone knows that if a dark honey is sold to your grocer this year and a white honey the next year that the housewife, upon buying the second time, will question the purity of the product that does not look like the product she bought before and was satisfied with. This is easily overcome in the bottling of honey by blending the various colors and grades. Blended honey on all the shelves of every grocery store will be approximately the same body, color and flavor year after year. The food value of the blended package is just as great as the unblended package, and is worth in every way just as much money as the straight product. As a matter of fact, the average commercial bottler's plant is so clean that the blended product is frequently far superior to most of the unblended products sold by many producers of honey.

In times of a dearth of honey in the region producing light colored honey, or in the region producing dark colored honey, it is an easy matter to provide a supply if it can be shipped in and by being blended have the same appearance on the grocer's shelves in that territory as it had the year before. Since this can be done and does not in any way affect the purity or food value of honey, and since it is one of the most commonly accepted principles of merchandising that a continuous identical supply of each foodstuff is necessary for its continued sales, this apparently offers an entirely legitimate and successful method of operation.

Perhaps there is more discussion today among beekeepers about the prices at which honey should sell than any other question. In most localities honey does not bring what it is worth, primarily because the average beekeeper peddler first hasn't the backbone to charge what it's worth; second, the average beekeeper, peddler or not, unfortunately thinks that when things are sold direct to the consumer that it is perfectly proper to cut the life out of the prices charged by the regular channels of trade.

It is perfectly reasonable then to expect that the fifth premise adopted by the Wisconsin Association, according to Dr. Fracker, should have been "A fair price, not too high in comparison with sugars and preserves, but one which means *some profit to the retailer and wholesaler as well as to the producer*."

Any beekeeper who takes the time will realize that, if he recognizes that his endorsement of a food product among strangers has no standing as compared to the label on a package of some nationally known grocery house of first credit rating.

Therefore, it is not unexpected this fifth premise adopted by the Wisconsin Association urging sales through the legitimate channels of trade should have the endorsement of that dean of wholesale grocers, Mr. Ezra Warner of Chicago.

He says the second feature paramount for the marketing of honey successfully is "Selling through channels of distribution for more protection to the consumer."

This is a point that should be very carefully thought over by every beekeeper today. Ninety-nine per cent of the food products entering the American home come from the local grocer. Why then, should the beekeeping fraternity, as an unknown quantity, attempt to set itself up as a substitute for the channels that supply 99% of the food products to the American home?

There are about 233,000 retail grocers in the United States who handle more than 12½ billion dollars worth of food products per year. Most of these food products are bought from a wholesale grocery house of good standing, like Sprague, Warner & Company, for instance. The grocer knows that he must have an endorsement better than his own to sell food products in his own locality. Therefore, he purchases from the wholesale house whose labels are nationally advertised and backed up by an absolute protection to the customer of maintenance of quality. Therefore, a grocer finds it easy to sell such trademarked products and also impossible to sell such hit-or-miss products as the average jar or pail of honey crudely put up, perhaps even dirty, not to say unendorsed by anyone of standing.

The grocer is entitled to a legitimate profit and in the case of honey is probably entitled to more profit than he makes on nationally advertised brands of food. This is because the market for these has been created for him, while he must stop in his rush and hurry to devote more expense and time in attempting to sell honey than nationally advertised products in his store. It is a well known fact, proven by dozens

of careful investigations, that women buy more food products than men where these products are offered through the legitimate channels of trade.

There seems to be light ahead and American beekeepers can safely assume that as a general rule they are on the right track, for the following reasons:

1. There has never been a time when more effort and publicity was being given to educating producers and buyers of honey as to what honest grades are.

2. Certainly at no time in the history of honey marketing have more rapid strides been taken towards the use of more attractive containers and labels and cleanliness of the product.

3. While the national, or even regional, merchandising of honey has not appeared, and may not for many years, most of the efforts used by beekeepers and called advertising and publicity are doing much to remind purchasers of the use of honey. Perhaps nothing more deplorable occurs in this case than the widespread advertising that American foul brood occurs, for while we beekeepers know it has nothing to do with the cleanliness or food value of honey, it certainly is not appetizing to the buying public.

4. Perhaps the least progress is being made right now to afford a *continuous supply of honey* to the channels through which it is being sold. The writer realizes the danger of prophecy, but is willing to hazard a guess that nothing is deterring the national use of honey more in these present times than the lack of an adequate, similar and constant supply of honey in the markets where it occasionally appears.

5. The prices at which honey sells are in most cases perfectly fair and legitimate where it is sold through the regular channels of trade, such as grocery stores. Unfair prices are found on dining cars and in restaurants, as in most such cases these are unreasonably high. Unfortunately, as we previously said, most beekeepers are peddlers, and as most peddlers sell their product for less than a good product is worth through the legitimate channels of trade, we believe that in most cases where honey is sold direct to the consumer, it is sold at too low a price. However, it would be unreasonable not to admit here at this time that a great deal of progress is also being made in this line.

Through his friendship for the writer, Mr. Carroll Dean Murphy, an advertising man, has recently had a great deal of contact with the beekeeping industry. He says that present attempts to market a widely produced product like honey, over the production of which the marketers

have no control, is folly. The California cooperators are frequently quoted by some people in talking to beekeepers, who are always careful to omit that these cooperative associations in some cases control absolutely more than 90% of the total production of their product in the United States. They are, therefore, in a position to obtain a fair price for their products. The bottler or large seller of honey who is knifed in the back by the beekeeper is, unfortunately, not in such a position of control, and his frequent disgust at the sales tactics of many American beekeepers is not unexpected.

On the other hand, Mr. Murphy believes that it is perhaps not impossible, but undesirable, to attempt the great task of trying to market honey nationally at one full swoop. This entails national advertising, which requires thousands of dollars, and necessitates the enforcement of grading, which is now next to impossible in the case of honey, for there is no way to force the producer to ship his honey to the bottler or any reliable source where the proper grading and blending would take place. Without this no sensible individual or association can attempt to advertise nationally a product over which they have no control as to its cleanliness, purity and grading, not to mention the container and its appearance.

Again, this advertising authority suggests the cooperation of two or more successful producers' associations in reasonable proximity to each other to pool their crop, sell it through one manager under one label, and through the legitimate channels of trade. He believes that honey so marketed could be sold at a price to include the cost of any reasonable advertising campaign, provided the pooling of this association was marketed in a restricted area at first, such as from one large nearby city. Inasmuch as this has been used in the marketing of other food products whose whole situation is similar to the marketing situation of honey, and inasmuch as these other attempts have usually been most successful, it is reasonable to assume that this advice is sound.

Mr. Murphy further suggests that after one group of producers has succeeded in their locality, they try a second locality, maintaining their distribution and advertising in the first locality, or that they cooperate with a second association of producers in another region, to dispose of their excess crop. He believes the country could be divided into about 15 or 20 such regions, and in the course of a reasonable time, say 20 years, that the national advertising of honey could then be attempted and paid for out of the product as it was sold, that the product would have a guarantee it required, and its distribution through the legitimate

channels of trade. This would avoid glutted markets in one locality and scanted or neglected markets in another. At least, this opinion sounds more reasonable than any other that has so far been presented to the writer.

Therefore in closing, while I realize that only one plan of national marketing has been suggested in this paper, and that it is untried, I hope that the facts that have been presented here will at least make you realize the enormous possibilities of honey production in this country, running into the millions of pounds. The sadly neglected market awaits the sensible attention of those individuals, whether producers of honey or not, who will at least be conservative and not attempt to market their product in a way that immediately stamps every legitimate channel of trade as an enemy of honey.

CHAIRMAN R. L. WEBSTER: The next is a paper by T. H. Frison.

EXPERIMENTS IN ATTRACTING QUEEN BUMBLEBEES TO ARTIFICIAL DOMICLES[1]

By THEODORE H. FRISON, *Illinois State Natural History Survey, Urbana, Illinois*

ABSTRACT

The securing of the nests of bumblebees for study and experimentation by attracting and inducing the queens to nest in artificial domiciles is a great improvement over the chance locating of their nests. Mr. F. W. L. Sladen first experimented with this method in England in 1912. Experiments with a similar purpose but using domiciles of a new design were undertaken in the vicinity of Urbana, Illinois, by the writer during the years 1915–1917 and 1919. Seventeen of a total of thirty-six domiciles or about forty-eight per cent, were selected by queen bumblebees for nesting quarters. These results compare favorably with those obtained in England by Sladen.

Securing the nests of bumblebees by attracting the queens to artificial domiciles is a great improvement over the chance locating of their nests. As far as I am aware, this method was first employed by F. W. L. Sladen (1912) in his excellent studies of the bumblebees of England. He devised and used several types of domiciles. Each of these types centered about the idea of placing some soft nesting material in a protected excavation in the ground, and then covering over the top of the hole

[1]Contribution from the Entomological Laboratories of the University of Illinois, No. 101. Extract from a thesis presented to the Faculty of the Graduate School of the University of Illinois in May, 1923, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

with a piece of tile or a wooden cover. A small tunnel leading to the nest was then constructed by driving a steel implement into the ground, directed at an angle that caused it to enter the excavation. Later Sladen used what he termed a "tin domicile." In this latter type a tin cylinder was placed over the excavated hole containing the nesting material and then the cylinder was covered with a tin lid. The tunnel leading to the nest was made the same way as before. For a more complete description of the domiciles used by Sladen and the results obtained by their use, the reader is referred to Sladen's book. It may be added, that with increased protection from mice, shrews and moisture his efforts were productive of gratifying results. Sladen lost colonies thru their destruction by ants (*Lasius niger* and *Myrmica rubra*), shrews, mice and voles, and therefore devised means for the protection of colonies established in his domiciles.

In connection with my studies I have used domiciles of my own design. The general principles of these domiciles are naturally the same as those of Sladen's, namely, a duplication of conditions that are required to satisfy the nesting instincts of the searching queens. No special contrivances were divised to keep out the enemies of the bumblebees. The domiciles were so made that small animals, such as mice, could gain access to the nest only thru the entrance. Until the spring of 1919 I never lost a colony once established in a domicile thru its destruction by mice. In that year, 1919, due to the work of the mice, I lost two colonies of bumblebees that were started in my domiciles at White Heath, Illinois. One of these incipient colonies was that of *Bremus impatiens*, a species I was particularly anxious to get at the time. On May 17, 1919, when I examined the nest for the first time, the queen was at home and her first brood had already spun cocoons. A few days after this I found the nest completely destroyed and the domicile in the possession of a field mouse. In regard to the other nest referred to above, I never even learned what species of bumblebee had occupied the nest for the queen was out foraging when I first examined the domicile and observed that it was occupied. When examined a few days later the rapidly developing first brood had been destroyed, presumably by field mice. Certain parasites and inquilines of various kinds occasionally entered the domiciles, but in the majority of cases caused no serious damage, and helped me to gain some information concerning the insects frequenting the nests of the bumblebees.

Construction of Domiciles

The first domicile I used was made from a coffee can. A large-sized coffee can, 5 in. by 6 in., formed the main body of the domicile. The

lid of the can was provided on the top with a handle or grip. Near the bottom of the can on one side was cut a circular hole 1 3/8 in. in diameter. A tin spout varying in diameter from 1 3/8 in. at its base to 1 in. at its top and 13 in. in length was used as an entrance to the can. The spout was soldered to the can in such a manner that it assumed an angle of about 35° pointing towards the top. The top of the spout was then about 3 in. above the top of the can. The free end of the spout was then cut in such a manner that its edges were parallel with the top of the can. Thus, when the domicile was buried a few inches under the ground, enough so that the top was well covered over, the spout was at the surface and level with the ground. Paint was poured down the inside of the spout and then sand or sawdust sprinkled thru the same before the paint dried; thus affording a good footing for the bumblebees. Inside the domicile I placed a quantity of dry grass from the nest of a field mouse. A coat of paint helped to prevent the rusting of the domicile. The chief disadvantages found with these domiciles called type A, were that the lids rusted on, excessive moisture collected in the bottom of the cans, and it was not always easy to procure the cans in numbers.

In the spring of 1916, a new type of domicile, which I shall refer to as type B, was constructed. This type of domicile possessed many advantages over the former one. It differed from type A in that it was provided with a removable glass top beneath the real tin top covering, while a smaller and better-sized tin pail formed the main body. This domicile was not so high as that of type A and consequently might have a shorter spout. The secondary glass top was a decided advantage, in that the lid might be removed from the domicile without danger of the bees flying out if the nest was occupied. Furthermore, when the lid was removed in order to examine the contents, dirt did not fall into the nest. A ruby colored glass top likewise kept bright light from the nest when it was being hastily examined and hence there was less chance of disturbing the bees. The tin pail was also vastly superior to the coffee can for a domicile as the lid did not rust on as easily, a handle was already provided,

Fig. 2.—Domicile, type B.

the tin pail was more substantial, and tin pails could be purchased in quantity. Figure 2 is a photograph of this type of domicile.

In 1917, another type of domicile, which I shall call type C, was used together with some of type B with certain minor improvements. Type C was made from cypress wood and nearly square in outline. The lid was of wood and opened on hinges, beneath which was a second removable glass top, as in type B. The spout was made either of tin or of a piece of old rubber garden hose. The garden hose, being flexible, was especially adapted for use when the domicile was placed in a tree stump or log. The bottom of the box was open and screened with a very fine, strong copper gauze. Figure 3 is a photograph of domicile type C. Type B was used also in 1917 with the bottom removed and a piece of fine copper gauze soldered over the opening in the bottom as in type C. The gauze bottom was an advantage in that it provided a drain for excessive moisture but still prevented certain insects and mice from entering the nest thru the bottom. The soil beneath a domicile, if the situation is properly selected, is rarely moist enough to cause the bumblebees trouble. In the spring of 1919, domiciles of both type C and the improved type B were used.

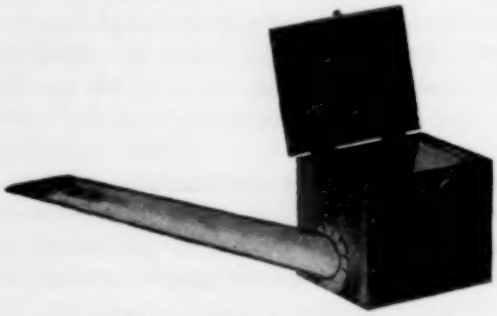

Fig. 3.—Domicile, type C.

Factors Governing the Successful use of Domiciles

A great deal of the success in the use of domiciles depends upon their correct placing. This depends in large measure upon a knowledge of the situations selected by the searching queens and upon the fact that some species of bumblebees tend to select different habitats. If one wishes to secure colonies of *B. impatiens* or *B. bimaculatus* in the vicinity of Urbana, Illinois, it is folly to "plant" the domiciles in the open fields or pastures. These two species are dominantly woods-inhabiting bumblebees, and one stands a far better chance of securing the nests of these two species if the domiciles are buried in or near the border of a woods. This is well illustrated by a survey of the bumblebee fauna near Urbana. Queens of these two species may be found in abundance in early spring in the University Woods (Cottonwood) about three miles

from Urbana, and in the Brownfield (Augerville) Woods about two miles from Urbana. These two wood lots of about forty to sixty acres each, respectively, are about one mile apart. In and about Urbana in the open country only isolated specimens of the queens of the two above-named species are found, but in these two small restricted wooded areas they occur in abundance. There are many factors that control this distribution, principally the early blooming wild flowers, hibernation quarters, nesting situations, and sylvan conditions. With *B. americanorum*, however, such is not the case. Domiciles placed in pasture or meadow lands are the more likely to be inhabited by this species

The domiciles must be placed in the ground before or soon after the queens emerge in spring from their winter quarters. One desirous of obtaining colonies by this method should keep in touch with the advance of the season in his particular locality. The actual time of appearance of the queens varies with the climatic conditions. In some years domiciles can be buried at Urbana for the woods-frequenting species of bumblebees by the last of March. In the spring of 1920, however, it would have been useless to bury the domiciles much before the last of April because of the continued cold and rainy weather.

Bumblebees also present what I term an *appearance-succession*, which is discussed in an unpublished manuscript. By reason of this appearance-succession of species of bumblebees, domiciles can be placed in the ground for some species later than for others. Domiciles for attracting the queens of *B. americanorum* may be placed in the ground at least two weeks later than those buried for attracting the queens of such species as *B. impatiens* and *B. bimaculatus*.

The manner of burying the domiciles after the site is once selected is a simple matter. A hole large enough to accommodate the domicile is dug in the ground at such a depth that when the domicile is buried in the excavation the open end of the spout will be on a level with the surface of the ground. The top of the domicile is then covered with the excavated earth. If the domicile is buried in ground covered with sod, a piece of the sod the size of the desired hole should be removed and then carefully replaced after the domicile is buried. A piece of old board, hay, or a portion of an old log laid over the covered hole helps to conceal the spot from curious persons and also aids in attracting queens looking for nesting situations. The place of burial of the domicile must be concealed as much as possible without covering its entrance. It is best to bury the domiciles on private premises, as here there are fewer chances of their being disturbed. In 1919, I lost nearly one-half of my

domiciles thru theft, even in such so-called private places as the University Woods.

Sometimes it is advantageous to place the domiciles in tree stumps or old logs, hiding them in such a manner that only the entrance of the spout shows as a hole in the stump or log. The spout should be cut off so that it does not protrude irregularly from the place of its concealment.

Results of Experiments with Domiciles

Table I gives in tabulated form the results gained by the use of domiciles in the springs of 1915, 1916, 1917, and 1919. Because of the success I had in the spring of 1919 in getting the queens to rear their brood in confinement, I thereafter discontinued the use of the domiciles as a means of securing colonies of bumblebees for my studies.

Table I

Domicile Number	Type	Place	Date placed in the field	Result	Remarks
1	A	Champaign	April 2, 1915	Not occupied	
2	A	"	" 2, 1915	" "	
3	A	"	" 9, 1915	" "	
4	A	"	" 14, 1915	" "	
5	A	"	" 14, 1915	Occupied by *B. americanorum*	
6	A	"	" 19, 1915	Not occupied	
7	A	"	" 19, 1915	" "	
8	A	Urbana (University Woods)	" 30, 1915	" "	
9	A	"	" 30, 1915	" "	
10	B	White Heath	" 15, 1916	Occupied June 24, 1916 Species?	
11	B	" "	" 15, 1916	Occupied by *B. auricomus*	Successful termination
12	B	" "	" 15, 1916	Not occupied	
13	C	" "	" 9, 1917	Occupied Species?	
14	C	" "	" 9, 1917	Not occupied	Stolen
15	C	" "	" 9, 1917	" "	
16	B	" "	" 9, 1917	" "	
17	C	" "	" 9, 1917	Occupied Species?	
18	C	" "	" 9, 1917	Not occupied	
19	C	Urbana (University Woods)	" 12, 1917	Occupied by *B. bimaculatus*	Successful termination
20	C	"	" 12, 1917	Occupied Species?	
21	C	"	" 12, 1917	Occupied by *B. separatus*	Successful termination
22	C	Champaign	" 16, 1917	Not occupied	
23	B	"	" 17, 1917	" "	
24	C	Urbana (University Woods)	" 17, 1917	" "	
25	C	"	" 17, 1917	Occupied by *B. americanorum*	Successful termination
26	B	"	" 17, 1917	Occupied by *B. bimaculatus*	" "
27	B	"	" 17, 1917	Occupied and deserted twice Species?	
28	C	White Heath	" 9, 1919	Not occupied	
29	C	" "	" 9, 1919	" "	
30	C	" "	" 9, 1919	Occupied Species?	
31	C	" "	" 9, 1919	" "	Destroyed by mice
32	C	" "	" 9, 1919	Occupied by *B. impatiens*	" " "
33	C	Urbana (Brownfield Woods)	" 12, 1919	Not occupied	Stolen on April 22, 1919
34	C	"	" 12, 1919	" "	" " " " 1919
35	C	"	" 18, 1919	" "	
36	C	"	" 22, 1919	Occupied by *B. americanorum*	Successful termination
37	C	Urbana (University Woods)	" 22, 1919	Not occupied	Stolen sometime before May 11, 1919
38	C	"	" 22, 1919	" "	
39	C	"	" 22, 1919	Occupied Species?	
40	C	"	" 25, 1919	" "	

Table I shows that seventeen of a total of thirty-six domiciles, or about forty-eight per cent, were selected by bumblebee queens for nesting quarters. Excessive moisture was responsible for the desertion of the nest by the queens in only two instances. In the case of both of these desertions the domiciles were of the old type A, which did not permit of proper drainage. This defect was remedied in the domiciles of types B and C used in 1917 and 1919. Mice destroyed two of the nests and I could not determine the cause of the remainder of the desertions. The queens may have been killed while they were away from the nest, or perhaps they found a still more favorable site. It is evident that a greater percentage of domiciles were chosen by the queens each successive year. This shows either that better places were selected for the burying of the domiciles or that the improvements in the domiciles better suited the instincts of the searching queens. Probably the increasing percentage can be attributed to both the two mentioned causes.

Summarizing, these experiments show that if the domiciles are buried in the ground in spring in favorable locations, a gratifying number of them are likely to be occupied by the queens. Further, the results of their use in this country compare favorably with those obtained in England by Sladen, tho judging from Sladen's book, bumblebees in number of individuals are more abundant in England than in Illinois.

CHAIRMAN R. L. WEBSTER: The next paper is by C. P. Dadant. Mr. Frank C. Pellett will read this paper.

THE DISEASES OF THE ADULT BEE

By C. P. DADANT, *Hamilton, Ill.*

If I have chosen the subject of the diseases of the adult honey bee for my address at this meeting, it is not in order to mention the different bulletins that have been written on this subject, or to criticize them. In fact, I am not able to give any light or bring any suggestions, for I am not a scientist; but as a practical beekeeper I wish to draw the attention of the men of science to the fact that, so far, very little reliable information has ever been supplied on the matter of adult bee diseases.

In Great Britain, a mite has been discovered, the *Tarsonemus woodi*, which is supposed to be the cause of the Isle-Of-Wight disease. But a different living being, the *Nosema apis*, discovered in Germany, was formerly charged with being the culprit. The fact that *Nosema apis*

was discovered in large numbers in the body of perfectly or apparently healthy bees has thrown some discredit on this supposition.

Similarly, the existence, in the United States, of a disease with almost the identical symptoms of the Isle-of-Wight disease, while no one has yet found the *Tarsonemus woodi* on this side of the Atlantic, would at least throw very strong doubts upon the belief that this mite is the cause of the disease.

The diseases of the adult bee are very similar, although designated under different names. Paralysis, vertigo, May disease, constipation, dysentery, Isle-of-Wight; all these troubles are indicated, by inability to fly, restlessness, more or less swollen abdomen, with a consequent shortening of the life of the workers, and a depletion of the hive. Occasionally, the queen, even, suffers from the trouble and dies.

Neither has the locality much to do with the troubles. Being in correspondence with a number of leading beekeepers, I heard of trouble, at the same time, in Florida, from a well known beekeeper, O. O. Poppleton, and in California, from another well known beekeeper, Major Merriam. Each ascribed the trouble to local conditions, while they were so far apart and their conditions were so entirely different. It is still more interesting to learn that at the same date, the beekeepers of the province of Ancona, in Italy, were troubled with a similar scourge. There, also, they were ascribing the trouble to causes that did not exist in either California or Florida.

We, ourselves, at different times, saw a scourge of this kind in our apiaries. We ascribed it to the results of a hard winter. As most of the bees that are diseased have their body filled with a disgusting fluid, we thought that the trouble was caused by constipation, or the inability of bees to discharge, from their abdomen, the feces of the winter. We lost, occasionally, a number of colonies in spring, from this trouble, which is usually ranged by beekeepers under the title of "spring dwindling."

Another trouble, of the same sort, made its appearance, from time to time, in May–June. It is manifested, like the above named troubles, by the inability of bees to fly; but it does not last over a day or two and the bees that suffer from it usually gather about, in clusters, in front of the hives, until, at the end of the time, they appear to regain their strength.

Are these troubles produced by the same causes? In some conditions, we believe we can see an explanation to the difficulty. For instance, in dysentery and constipation, in countries where the bees are long con-

fined by cold weather, it is not difficult to understand that the food of the bees may have been sufficiently laden with impurities, to overload their abdomens and cause diarrhæ, or dysentery, which, if too long retained within their bowels, may change to constipation or an inability to discharge the feces.

But in countries like Florida, South California, or Italy, where the winter is of no duration and not rigorous at any time, we must seek for some other cause, or must describe the disease as different, although the symptoms are similar.

A number of students have attempted to diagnose these different troubles which appear so similar in their manifestations, but nothing positive has been done. Probably the *Tarsonemus woodi* and the *Nosema apis* have influence upon the diseases, but what will we say where those mites do not exist, or where they are found in perfectly healthy colonies?

In the diseases of the brood, much progress has been made, in the last 40 or 45 years, thanks to such men as the German scientists, the English Cheshire and Cheyne and our own American students, Phillips, Dr. White, and others. Perhaps Dr. White should head the list of helpers, since it was he who found out that the real bacillus of foulbrood was *Bacillus larvae* and that *Bacillus alvei*, of Cheshire, is only a bacillus of putrefaction which comes after the damage is done.

But in the diseases of the adult bees, none of us, men of daily practice of beekeeping, is yet satisfied that the proper causes have been given in every case. We need more studies by scientists, and since we cannot make the studies ourselves, there is nothing for us to do but to point out the difficulties and ask those who can penetrate in the domain of the microbes, to study and suggest the possible causes of these troubles which are so very similar in their outward appearances. As in the foulbroods, there are probably differences between the diseases in question which may be recognized easily when pointed out or suggested.

One very positive fact, which I believe was ascertained everywhere, is met in the diseases of the adult bees. It is the dampness of the atmosphere at the time when the diseases are at their worst. This appears to be uniform, in Great Britain or the Isle-of-Wight, in Florida, in California, in Italy and even here with us in the north portion of the Mississippi Valley.

Although these diseases, as a rule, do not seem to be contagious or epidemic, but simply endemic under certain conditions, yet their appearance is so general, at times, that some people consider them as

epidemic, but we do not believe that there is any contagion in them as there is in foulbrood.

There are so many things that we don't know, when we study, with a view of overcoming trouble, that we feel quite free to suggest possibilities, when we may be far away from the real facts. But it is in meetings of this kind that we may look for relief, or at least for studies leading to relief. As I believe that a matter of this sort needs much discussion, I do not wish to write a long address. It will be quite sufficient if I can awaken interest in the students who listen to this short statement.

CHAIRMAN R. L. WEBSTER: Some of you may be interested in knowing that in North Dakota one of my students found a dipterous parasite of the honey bee, not a new parasite because it is one that has previously been found in the bumble-bee; in fact, Dr. Frison mentioned it yesterday in another society. It is one which apparently has never been seen affecting the honey bee. I brought with me one or two drawings and some figures which I will pass around, and also a vial showing some of the larvae of this interesting little parasite.

CHAIRMAN R. L. WEBSTER: The next is a paper by G. H. Vansell.

RESULTS FROM THE USE OF A WATER-SOAP-FORMALIN SOLUTION FOR STERILIZING AMERICAN FOULBROOD COMBS

By G. H. VANSELL, *Davis, Calif.*

ABSTRACT

Combs infected with *Bacillus larvae* White can be economically sterilized. The solution of alcohol and formalin can be satisfactorily replaced by a much cheaper solution of Water, Soap, and Formalin. The sterilization is easily accomplished by the removal of the honey and immersing the combs in the formalin solution for 48 hours, after which they are aired and ready for further use in the colonies.

American foulbrood is the most serious disease known to apiculture today and is responsible for an untold loss to the beekeeping industry. Economical production of honey is not possible in an apiary where disease is rampant. The loss caused by the destruction of bees, combs, honey, and hives in the earlier treatment of American foulbrood was too great to be borne by many beekeepers and they have ceased to try to keep bees, as the decreased production or the increase in the cost of production has not been met by a commensurate increase in the market price of honey. The sharp decline in honey prices following the close of

the recent war in conjunction with the increase in the cost of production has brought the financial condition of many other beekeepers (at least in California) to a point close to insolvency.

The causative bacterium is *Bacillus larvae* White. It is a motile, spore-forming organism possessed of marvelously rapid reproductive powers and extreme longevity. The spores remain viable after exposure to boiling water for ten minutes and under ordinary temperature for years. In honey this resistance is even more marked. The extreme resistance of the spores has been a stumbling block in the successful curative treatment of this disease and has resulted in the destruction of infected hive parts and other materials by fire.

It is now common knowledge that the older method of destroying the combs has been supplanted so that it is possible to successfully treat even the infected combs. Dr. J. C. Hutzelman with others in the fall of 1923 announced success through the use of an alcohol-formalin mixture. This solution is highly efficient and the cost is low enough to permit its use commercially since thousands of gallons are being used annually at present. However, a much cheaper water-soap-formalin solution is now available. This solution was first developed at the University of California Agr. Exp. Station in 1924 as announced in the American Bee Journal **65** : 55 and 446 and the JOURNAL OF ECONOMIC ENTOMOLOGY **18**: 576. In comparative trials for efficiency in sterilization, no distinct advantage was found which would justify the recommendation of one mixture over the other—both are good. The process of treating and handling the combs with this water solution is exactly the same as in the use of the well advertised alcohol-formalin solution. Great care must be used to be sure that all cells are open.

It has been held by some that a plain water-formalin mixture lacks in penetration power, but the presence of the soap spreader increases this so that even this criticism can no longer be justified. Also the soap makes the mixture sufficiently alkaline to prevent precipitation of paraform from the formaldehyde which would weaken the killing power of the mixture. Material of this type which has been mixed and used for fifteen months (July 1924–September 1925) is still being used satisfactorily.

The solution is made up by using one gallon of soft water, two ounces of liquid soap, and one quart of formalin. The liquid soap is simply stirred into the cold water. (This particular soap is recommended because it is readily miscible with water.) The formalin is then poured in and the mixture stirred again. If it is necessary to use hard water, a

little more soap should be used since some of it is precipitated by the chemicals in the water.

The California Experiment Station is using 1400 of these treated combs in the apiary at Davis. Thousands of them are in use in cooperating apiaries over the state with perfect satisfaction. Where the work of sterilization was done carefully there have been no complaints registered.

It is with a great deal of satisfaction that we are able to recommend the use of this material. The cost is so low that the production of honey at profit seems assured in spite of the wide dissemination of *Bacillus larvae*.

MR. A. H. DUNN: Have you any records on your recurrence?

MR. G. H. VANSELL: We have had some recurrence in the use of all solutions, but never when they could be traced to anything except reinfection; where the work has been done carefully, largely by myself and the laboratory, we have never had any comebacks from any of them.

MR. LEWIS: After treatment of the combs do you use any means of cleaning the combs or do you hang them up and let them dry? You didn't rinse any soap off or anything like that?

MR. G. H. VANSELL: We have done that and then aired them and dried them, but it doesn't seem to make any difference.

MR. E. A. LEWIS: The A. I. Root representative from Council Bluffs where they have their Iowa station told us last spring at a state meeting that he put combs back into the hive when they were strong of formalin yet, of Hutzelman's solution, and the bees accepted them very readily.

MR. S. B. FRACKER: I should like to ask Mr. Vansell if he has found closed cells.

MR. G. H. VANSELL: I am very careful to uncap all brood cells and all other cells. That is one of the important points. What is the use to run the risk of leaving them closed and take chances? I have had comebacks from that standpoint with the alcohol formalin mixture. I open every cell; I use an old steel brush and it doesn't take but a second to scratch off the top.

MR. S. B. FRACKER: We have had no comebacks in the case of leaving the brood cells closed with the Hutzelman solution, because the alcohol seems to penetrate through the cap of the brood cells.

MR. C. S. RUDE: How are you going to uncap cells where the cap is half way down the cell and then they fill out on top of that and cap on top of that yet?

MR. G. H. VANSELL: I uncap in the usual way; then I hold it up to a light and look over the comb quickly, and if there are any cells in there, open them with a nail. I am sure they are all open, and you have got to be sure, there is no other way out of it. You have got to do careful work in everything.

MR. E. A. LEWIS: I might explain that I look at this question not only from the viewpoint of experimentation but from the viewpoint of the commercial beekeeper. There have been some reports lately of the discovery of queens whose bees were immune to foul brood. I wonder if this Association knows anything recent about that?

MR. F. C. PELLETT: I happen to know of a man who was first to call attention to the immune strain of bees from American foul brood. I have been following this work through the past six or eight years, and while there is occasionally a colony that very definitely seems to be immune, cleans up the disease when given combs that are rotten, but doesn't seem so far to transmit the characteristics, when this colony supersedes their queens, then they seem to lose this ability and the disease reappears. So far nothing has been accomplished that looks like anything more than an incidental or sporadic case.

CHAIRMAN R. L. WEBSTER: The next paper is by O. W. Park.

WATER CARRIERS VERSUS NECTAR CARRIERS

By W. O. PARK, *Iowa Experiment Station, Ames, Iowa.*

(Paper not received in time for publication here.)

CHAIRMAN R. L. WEBSTER: There are two titles which are not on the printed program for which I will call at this time. The first is by Ralph L. Parker.

THE UTILIZATION OF POLLEN AND POLLEN SUBSTITUTES BY THE HONEYBEE

By RALPH L. PARKER, *Kansas State Agricultural College*

ABSTRACT[1]

Pollen—a substance produced by flowers of plants and collected by bees—is the chief source of protein food of these insects. A lack of pollen causes a cessation or a slackening of brood-rearing, while pollen

[1]This paper is an abstract of a portion of a thesis presented in September, 1925, by the author to the Graduate School of Cornell University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

coming to the hive acts as a stimulus to brood-rearing. When there is a plentiful supply of pollen in the hive and other conditions are favorable, brood-rearing progresses rapidly. During the period of mass feeding (the first two days of larval life), royal jelly, a concentrated food of a predigested nature secreted by the younger worker bees, is supplied abundantly. For the remainder of larval life, undigested pollen is mixed with the food derived from a secretion.

The bee, when eating pollen, scrapes it from the stored mass or from the pellets brought to the hive by worker bees. The pollen grains are worked between the mandibles by an alternate up and down motion, and then they are gradually worked up to the mouth. The mandibles, or jaws, have a ridge on the concave inside surface which is armed with short, strong spines, and the mandibles probably function as crushing or cracking organs in the preparation of pollen for ingestion. Pollen tubes, as in germinating pollen, have not been seen in pollen within the digestive organs of the bee, but grains which are cracked, or with a portion of the wall missing, are often found. The coats of pollen grains are made up largely of celluloses which the bees are unable to digest.

The contents of pollen grains in the normal expanded state completely fill the shell, but after passing through the alimentary canal of the bee, the contents shrink in many cases, due to the digestion of a portion of the mass. This occurs equally in the adult and in the larva. Some of the simple sugars and proteins are available to the bee, and these are the only food materials which occur in pollen that it is able to use as far as is known at the present time. Starches, dextrins, celluloses, pentosans, some of the simple and higher sugars, and the majority of the carbohydrates are not available to the bee, and probably this is also true of fats and oils which occur in pollens. Proteolytic enzymes—minute chemical bodies which cause complex proteins to break down into simple proteins, thus making these products available as food—have been shown to be present in the alimentary canal of the bee, and it is evident that the bee is able to use certain proteins found in pollen, but as yet these have not been identified.

Substitutes for pollen, such as finely ground rye, wheat, oats, pea meal, corn, buckwheat, and Mellin's food are not found to be beneficial. Larvae fed these foods die just after the period of mass feeding. During this early period, feeding is not as abundant as when pollen is present in the diet of the bee. The feeding of substitutes stimulates the queen to lay eggs and the nurse bees to feed the young larvae, but development is not completed. If the larval stage could be completed on a substi-

tute for pollen, it is probable that the larvae could not transform to pupae, due to weaknesses, as is indicated by the fate of the queen larvae which completed their larval growth and then died before the change to pupae occurred.

The substitutes used in this work do not take the place of pollen in the diet of the bee, and beekeepers in regions which at times experience a shortage of pollen during the early part of the active season should preserve combs of pollen for use at such times, since they cannot depend on the use of substitutes here studied.

MR. F. C. PELLETT: I think this paper is of good deal more than passing importance because in many localities the beekeepers are faced with a long period when there is no honey flow and in some places they are hard put to keep the bees alive during these periods of shortage.

There has been a great deal of discussion as to whether any substitute would keep the bees alive, especially in west Texas. It occasionally happens in some parts of Florida. It is apparent that the substitutes are valueless, and then it becomes a question of finding some means of providing a reserve supply of pollen for these periods.

CHAIRMAN R. L. WEBSTER: We have a paper which is not on the printed program, by A. C. Burrill.

FIELD NOTES ON HONEY FROM LONG-TUBED FLOWERS

By A. C. BURRILL

ABSTRACT

Restatement of a long dispute: Scientists say honey bee tongues can not reach nectar in long-tubed flowers such as red clover corollas or longer ones; but practical apiarists maintain honey bees get much yield from red clover besides pollen. Fair judges seem to have passed as from red clover, honey that was pink honey-dew, but normal color of true red clover honey not surely known. Scientists have failed to show how much bees follow insects that make holes in clover corolla tubes or gnaw tubes short, or droughts shortening tubes or in tubes of many wild flowers with longer corollas; new examples. Latest federal and state bulletins claiming red clover as a nectar source fail to offer proof how bees reach nectar, though Europeans claim honey bee tears its own holes. Appeal for more field notes and quantitative tests.

REASON FOR DISCUSSION. This topic restates a question common in American bee journals and has not yet reached the dignity of a thesis. It is a challenge to get more field research rather than a solution of a dispute. Frequent, conflicting observations on honey bees as visitors on flora like red clover which they are not supposed to visit for nectar

on the theory that their tongues are too short (Graenicher, 1910; Folsom, 1909, page 116), is warrant enough for this statement. The further tenet that honey bees can not use their jaws to bite into fruits and flowers as do some Aculeate Hymenoptera seems to be justified (cf. E. R. Root, 1911 (1908) p. 1) but may be affected by further observations.

Literature on Bees at Perforated Fruits and Flowers. The latter tenet, viz., that honey bees can not bite fruits or flowers has been well attested by Dr. Garman (1904), that snowy tree crickets and other insects make the abrasions in grapes, pears and other fruits, often by night, and the honey bee then feeds at the punctures by day and gets the blame for the holes or perforations they are found visiting. That the honey bee follows other insects seems to be increasingly common in the scarce literature, covering this topic on "Honey Bees and Perforated Flowers," as quoted by Robertson (1925). This aptitude to find ways to sweets through perforations by other insects may be considered a natural extension of the social instinct by which bees of the same or different hives search out stores of sweets indicated by other insects?

Examples from Literature. Just as honey bees follow into holes in pears and grapes and the like, where holes were made by grass culms as fruits fall, by tree crickets, ground beetles, wasps, or ants, so honey bees seem to visit spots where they can get sweet sap from pruned, wormbored, or other effect causing bleeding of box elders (*Acer negundo*), sugar maples (*A. saccharum*), etc., in early spring or at times when good nectar supply is scarce. Robertson quotes Sprengel (1793) and Mueller (1873) on honey bees seen making holes in the flowers of garden columbine (*Aquilegia vulgaris*), and Mueller again on perforating flowers of the European heath (*Erica tetralix*), and the Ground Ivy or Jill-run-over-the-ground (*Nepeta glechoma*). These are European observers and although the plants in question are grown in America, the observations do not seem to have been repeated in this country. Every summer in my youth I saw bees at the European ground ivy (*N. glechoma*) without noting perforations, at North Brookfield, Massachusetts. Dr. Pammel of Iowa (1883) has seen them at red clover (*Trifolium pratense*) but F. C. Pellett (American Bee Journal, March, 1923, p. 119) denies bees make any holes and some teachers of bee habits agree with this view. Pammel measured red clovers stunted by dry growing seasons and could find no results shortening tubes, so bees could reach the nectar. Pammel, (1888, p. 248) Knuth (1906–8) and others agree that the honey bee proboscis is too short to reach nectar.

Often Get Honey-dew for Nectar. My first field observations

were at the great clover aphis (*A. bakeri*) epidemic in South Idaho in 1916, when I was taken to a large red clover field near Nampa, Idaho, on the edge of the desert or non-irrigated lands, which nearly surrounded this particular field. The bees were here and not in the lava plain flora surrounding. Crystallizing honey-dew was on almost every blossom before the middle of August, and so much honey-dew was stored in the combs of leading apiaries (as E. F. Atwater, Meridian, Id.) in that vicinity, a wine-red nectar, making a red-tinted honey, that few questions were asked as to other sources of sweets, when thousands of bees were working the clover field. It may be honey-dew caused the red color in the following records on red clover: Red-tinted honey was shown by C. H. True, Edgewood, Iowa, at the State Fair one year per Pellett in his excellent review (July, 1918; ib. 1923, American Honey Plants: 289–293) and thin watery red honey has been seen by T. Rehorst of Fond du Lac, Wisconsin, while honey-dew from red clover leaves (only case in literature, Pellett, ib.) is reported in the American Bee Journal, 1903, page 491.

Clover Aphis Fauna and Perforated Flowers; Honey-dew vs. Sap Leaks. Due to the fact the Idaho epidemic occurred in a dry heat when nectar flow was wanting generally, bees were forced to seek honey-dew sources to survive the summer drought. The epidemic brought its train of lady beetles, western flower bug (*Triphleps tristicolor* White) and other insects, including a few undetermined Miridae (Burrill, 1918, pp. 421–2). Besides preying upon the aphis, some of these insects puncture the clover florets towards the base and must feed upon the nectar or plant juices there. The flower bug usually finds its aphis more common in the green leaf sheath bases or bracts of the leaves that subtend the flower heads, but the young nymphs wander through the fine spaces between the florets as in a miniature cane-break in the pursuit of young aphis instars. Some of these punctures exude sap, when the growing parts are turgid with sap. In infested clover fields, one finds an occasional morning when dew, despite the aridity, due to irrigation, is on the clover blooms, usually on the tops of the flower heads. Also there are globules of honey-dew under the clover head and in bad infestations, all through between florets (ib. p. 421). Besides, crystallizing globules are on the sides of florets close down to the calyx which I took to be honey-dew but now believe were drops of nectar oozing from punctures. Honey bees sipped at these lower globules when "passing up" or neglecting the more hardened crystallized honey-dew.

Bees Get Red Clover Nectar Also; Bumble- and Wood Bees

HELP. These sources of supply were not given much thought until the American Bee Journal and others (Pellett, ibid, July, 1918, 238–9; October, 1918, 347–8) took up discussion of why honey bees visited red clover. It was stated that in case of drought or epidemic, red clover florets are fore-shortened in the second crop and bee tongues can reach to nectar in these shorter florets at least on the outer circles (Folsom, 1909, p. 116; Phillips, 1915, p. 395; Dadant, 1922, p. 96; Phillips and Demuth, 1922, p. 9); Dietz (1925, p. 15); Pammel and Knuth (ib. Vol. 2, p. 289) to the contrary notwithstanding. This opinion is general, I believe: Pellett (ib., 1918) and Dietz (ib.) quoting many beekeepers on honey bees getting hundreds of pounds of nectar from red clover; and Phillips and Demuth (ib., p. 9) claiming it an important minor source of nectar. Now there are other ways of securing nectar and sweets that need more study than has been given bee habits. Knuth (ib.) says the English bumblebee pierces the tubes of clover flowers (Root, 1917, pp. 166–8, says bites holes in) and that honey bees later follow through these slits to obtain nectar; Schneck says (1891) our carpenter or wood bee (*X. virginica*) slits the lower end of red clover corolla tubes, followed by honey bees getting nectar there. Dadant (1922, p. 96) says some bees tear corollas to reach nectar, but it is too rare to be of practical value. Schneck adds that honey bees visit wood bee slits low on corolla tubes of *Pentstemon pubescens*, *P. laevigatus*, *Pontederia cordata* and *Astragalus canadensis*. He says (ib., p. 314) that Baltimore Orioles slit trumpet-flowers (*Tecoma radicans*) likewise to reach the nectar but cites no bee visits to slits.

BEES AND SAP LEAKS ON ALFALFA AND NORWAY SPRUCE. Following my 1916 observation in Idaho, I found in 1917 something going wrong with seed production of alfalfa towards Buhl, South Central Idaho. A Mirid whose work was sent to the Bureau of Entomology or Plant Industry without recognition and identification, punctured through forming seed pods into the seed, resulting either in a bacterial rot or wilting to a flat thin pellicle of what was left of the forming seed inside. A depression also occurred outside of the pod, indicating where seed failed to form, and on it, an exudate which dried down black gradually to form another kind of a pellicle on the exterior. This injury differs from clover-seed chalcis work, because that insect does not, to my observation, cause a failure of the usual formation of seed coats. Now, in the but fifteen minutes allowed me to observe this matter, an occasional honey bee came to the exudate where it was still fresh. Was it sweet? In the case of sapsucker injury to bark of Norway spruces in spring, we know the

exudate or sap was sweet and visited by honey bees, bluff of Milwaukee River, north Milwaukee, Wisconsin. I have waited eight years to repeat the alfalfa observation without success, and in studying at Logan, Utah, this summer, hoped to see this epidemic on alfalfa again. Though assigned to an alfalfa field in which I spent many hours each day, this Mirid and injury failed to come to my attention, so I am passing on the observation as a suggestion for any one who may be lucky enough to follow it up.

Wood Bees aid Honeybees to Bush Honeysuckle Nectar. Three years of desultory observations on the habits of wood bees (*Xylocopa virginica*) about bush honeysuckles, old porches, in grass, and other places, show that wood bees fly at temperatures in cold, late springs enduring about ten degrees more cold than field honey bees also flying for honeysuckle nectar. Thus honey bees failed to visit as often or on as many days, nectar sources such as perforated flowers, which soon wilt. Both wood and honey bees fail to reach to nectar in the long tubes of the bush honeysuckle (*Diervilla florida*) but the larger specimens of bumblebee (*Bremidae*) can reach the nectar. Mr. Ernst Schwarz, Preparator of the Missouri State Museum, urged me out to check up his wood bee observations and we found that the wood bees slit each honeysuckle tube in a longitudinal direction once or twice, usually close to the calyx tube or just within or under its sepal tips, and that honey bees go to the same slits for a means of ingress for their own mouth parts. Hundreds of flowers were so cut and directly visited by hive bees. . This may not have been put in print before, but its evident importance to the question of honey bees getting nectar from long-tubed flowers was noted in Science anent the long discussion as to whether honey bees do or don't get nectar out of clover florets with tubes longer than the reach of honey bee mouth parts. Honey bees are very essential to get large seed crops from red clover according to L. C. Aicher (1917, p. 1) and Westgate, Coe, Pammel et al (1915, p. 19) seem to say honey bees set more seed in Iowa than bumblebees and Phillips and Demuth (1922, p. 9) agree, claiming much of our American clover honey contains red clover nectar. Pellett concludes in 1918, "Whether the corollas are punctured by other insects, the tubes are shortened by drought or the nectar rises higher in the tube, remains to be proven," but in 1925 (ib., p. 590, Dec. No.) reports them seen at perforations of other insects in red clover corollas (also Robertson, 1925); and in his book, "American Honey Plants," (1923) found them getting at Buffalo currant (*Ribes aureum*) nectar where unknown agencies had slit the corolla tube entirely down

one side. Robertson (1925, pp. 287–8) reports three more species of American flowers from which hive bees get nectar through perforations made by wasps (*Odynerus* or *Leionotus*).

Ants Cut Stamens to Reach Fruit-tree Nectar and May Perforate Red Clover Bloom. In closing, I would like to record that ants have trouble in getting by stamen bars of apple and prune blossoms to the nectar cup, where bees and other flying creatures fly over the tops and in to reach nectar. I have found that *Formica integra* Nyl., a form of *F. truncicola* common to the Rockies and Inland Basin, gets around the difficulty by gnawing down one to three or four stamen bars while fresh and turgid, and thus gain access to nectar cup. Honey bees also use this entrance and exit on occasion. It seems from bagging such blossoms that apples develop but that single sepals may migrate to varying distances up to half way around or down the cheek of the apple before maturity. Some anatomists among the botanists might like to follow this lead. It will probably be found that common black ants (*Formica fusca subsericea*) have similar habits; and by night, carpenter ants (*Camponotus h. pennsylvanicus*), and mound-builders (*F. exsectoides*). On Idaho red clover, *F. integra* and *F. fusca* tend clover aphis, and also a tiny yellow ant. May these ants also gnaw holes in red clover corolla tubes? Ants gnaw trumpet creeper corolla (Pammel, 1888).

Wild Bees Replace Bumblebee Work on Red Clover in West. There is some doubt whether the larger bumblebees ever split down mammoth red clover corolla tubes as do carpenter bees previously noted, and it is still more doubtful whether bumblebees are of any importance to clover in irrigated districts due to their scarcity in some years. If bumblebee scarcity should prove general, there is an abundance of other native bees to take their place at least in South Idaho. I refer especially to the so-called "sweat bees" called to my attention by Dr. J. M. Aldrich of the National Museum, of the genus *Halictus*, whose colonies are often enormous, even in the edge of populous towns like Twin Falls, Idaho. A colony, almost half an acre in extent averaging at least one hole to the square yard in the railroad yards at Twin Falls, represented thousands of individuals. A similar colony was seen three miles away in the Snake River bottom on the Blue Lakes Ranch. They have been noted most extensively in L. C. Aicher's Bulletin 101 of the Idaho Agricultural Experiment Station together with the leaf cutting bees of the genus *Megachile*. Does their work aid honey bees to gather nectar in red clover?

Lady Beetles and Other Insects Perforate or Cut Clover

TUBES SHORT. Some lady beetles undoubtedly bite corolla tubes of red clover on occasion but whether honey bees get any advantage from their work, is not proved. There is much more to learn about the activities of the very common *Hippodamia convergens*. Its habits are quite varied with regard to feeding. Under my observation in daylight it sometimes fails to eat clover aphis but will sip at their honey-dew droplets. By enclosure in a tin capsule box or under cover of darkness, it suddenly goes into a wild frenzy of killing like a civit cat in a poultry yard and may destroy more than one hundred aphids in a few minutes, being entirely unable to consume its large kill. When there is no honey-dew about, it appears to try to perforate red clover corolla tubes in Idaho. I do not know if such habits have been recorded to eastward. There are many other insects whose habits in this connection may benefit honey bees (Folsom, 1909, p. 116, notes that grasshoppers, beetles, and caterpillars cut red clover tubes short).

DO HONEYBEES DO ANY PERFORATING IN U. S.? There is opportunity for every one to discover whether the honey bee can make its own holes in corolla tubes of red clover as reported for Europe. E. R. Root (1917, pp. 166–8; Dadant, 1922, p. 304) advocates raising longer-tongued honey bees, and in Europe is a call for red clover with shorter corolla tubes (JOUR. EC. ENT. 18, 6; 574, par. 5, "Apicultural Notes," 1925; also Dietz, 1925).

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MR. C. J. DRAKE: I would like to ask one question about the paper given. He mentioned the insidious plant bug. What species?

MR. A. C. BURRILL: The one we have been in the habit of calling the Phloeothrips. There may be other varieties.

CHAIRMAN R. L. WEBSTER: Next are two papers, the authors of which are not here.

Mr. S. W. Bilsing read the paper.

BRAULA COECA IN MARYLAND

By VIRGIL N. ARGO, *Cornell University*

ABSTRACT

An account is given of a study of *Braula coeca* as found during the summer of 1925 in parts of Maryland. The feeding and breeding habits are discussed and the economic importance of the insect pointed out.

Braula coeca, the so-called bee louse, was described in European literature as early as 1740. Nitzsch erected the species in 1818, but it was not until 1921 that definite observations on life history were made. At this time Skaife of South Africa established the fact that the insect lays eggs and is not one of the Pupipara as had hitherto been supposed. In 1923 Arnhart of Austria showed that the larvae develop in tunnels under the cappings of the honey comb, a point on which Skaife was rather indefinite.

Braula coeca has repeatedly been brought into this country with

shipments of foreign queen-bees. It has been introduced into colonies and after a period of observation has seemed to disappear. As a result the insect has been considered to be an interesting European pest which fortunately can not survive the living conditions on our continent. It is, however, common in parts of Europe which have as rigorous a climate as our own country; it spends its life within the shelter of the hive among the bees, which maintain a fairly uniform temperature; so there is no reason to suspect that it might not become established here. That is what has occurred. It may have perished in most cases when it was introduced into this country, but in some instances it has been able to survive and has become abundant before being noticed. Perhaps it gains a firm foothold slowly; but nevertheless, it has become of economic significance in some parts of the country and has been found in widely separated localities.

Braula was first reported to the Bureau of Entomology by Prof. Enos H. Hess in 1918, who found it in his hives at Grantham, Cumberland County, Pennsylvania, near Harrisburg. The next record came from Uniontown, Carroll County, Maryland, about twenty miles north of Fredrick. Mr. Rockward Nusbaum, the most extensive commercial beekeeper in the State, sent in these specimens taken from his bees in 1920. He claims to have observed the insects at least five years previous to this date without knowing what they were, thinking they were drops of propolis on the backs of the bees. In 1923 Mr. Charles N. Greene, Apiary Inspector for Pennsylvania, sent in Braula found in colonies of bees at Mechanicsburg, Cumberland County, not far from Grantham. It has been reported to have been found at Mankota, Blue Earth County, Minnesota, by Prof. A. D. Whedon about fifteen years ago.

This past spring and summer the writer has obtained records of the occurrence of Braula, either in the larval or the adult stages, from Grantham, Pennsylvania; and the following records from Maryland;—Flintstone, Allegany County; Williamsport and Smoketown, Washington County; College Park, Prince Georges County; Baldwin, Baltimore County; and thruout Carroll County. The most western of these records is the one from Flintstone, Maryland, well across the Allegheny Mountains from the other records in Maryland. A section of buckwheat honey showing Braula tunnels was obtained November 27, 1925, in a store in Ithaca, New York, this honey having been produced about thirty miles south of Rochester, N. Y. Mr. Nusbaum, in November of this year, reported to the writer having seen comb-honey from

Marlboro, Maryland, which showed quite extensive tunneling. This honey was on sale in the market at Washington, D. C.

The first time that Nusbaum's bees were examined in 1925 to see if *Braula coeca* was still present was on April 12. There had been some apprehension that the lice might all have died during the winter, but the first hive opened dispelled any doubt on this point. Braula was abundant, adults being commonly found on the worker bees and drones. A significant thing noticed at this time was that there were none on the queens and none were found on queens until September 6. All available writings stress the fact the Braula is found most abundantly on queens, no variation as to seasons being indicated.

When the hives were first opened in the spring, larval tunnels were observed under the cappings of the honey near the brood. Portions of the tunnelled cappings were removed and the tunnels opened. These tunnels are about 0.5 mm. wide and may become much branched, attaining a length of 5 cm. Cast larval skins, dead larvae, and dead pupae were seen, but no traces of living material were then seen.

Lice were observed to feed on bees that were confined in cages. In feeding the insect runs about on the head of the bee, showing great agitation, and then settles down on the clypeus, fastens the last pair of tarsal combs in the hair of the bee's face, and frantically claws at the labrum of the host with the other four tarsi. This continues until the bee slowly straightens out its tongue. The louse quickly moves forward so that it is able to apply its mouth parts to the base of the bee's tongue just beyond the edge of the labrum. In this position it remains quiet for a time, unless the available nourishment seems to become exhausted. This causes another rather hysterical outburst and the scratching of the labrum of the bee is resumed for a time sufficient to cause more food to be emitted, after which the Braula feeds until satisfied, and then returns to its usual resting place on the thorax of the host.

An attempt was made to determine the first date of oviposition. According to Skaife, the eggs should be found scattered over the combs rather indiscriminately. Adult females were collected May 16 with the last abdominal segments visible and extended, which was taken as an indication that oviposition might begin at any time; but all efforts to find eggs scattered over the combs were unavailing, and no sign of any larval activity was observed until June 12, when very small tunnels were found under newly capped honey. Dissection of tunnels

taken June 20 showed them to contain small larvae and at the beginning of the tunnel in each case an empty egg shell was found. The egg had been lightly attached to the underside of the capping of the cell and a little to one side of the center, very much as if the Braula had placed it there just before the cell was completely sealed over. Egg shells were found in all cases when tunnels were traced to their origin, and in each case the egg was found to have been placed in this same position; in no case during the season were eggs found anywhere except under the cappings of the honey cells. As the honey flow continued the tunnels became much more numerous and at the time of extracting June 27, they were found to be abundant in combs in extracting supers, as well as in the brood-nest. In some of the badly infested hives, four ten-frame, full depth, extracting supers were filled with honey, and all the combs were found to be heavily tunneled, to such an extent as to make comb-honey unsalable if it were damaged in like manner.

By the first part of July the supers had been taken off and the bees were again confined to two hive-bodies, which simplified the problem of studying the Braula population. It was found that during the month of July and the first part of August the number of adults was much reduced. In the latter part of July it was hard to find adults in colonies that were known to have been heavily infested earlier in the year, and which now showed many larval tunnels.

During the first week in September, queens were found heavily infested with lice, the first time this phenomenon had been observed during the year. Practically all the specimens then found on queens were pale in color, varying from white to a light tan color, distinctly different from the dark, reddish-brown color of the lice found earlier in the year. During the month of September it was found that the number of lice found on the workers had greatly increased, and collections were made but of all the ones taken on worker bees, none were found to be light in color. It would seem that the newly emerged Braula seeks the queen during the period in which its chitinous covering is hardening and gaining its dark brown color. In collections taken as late as October 20, there were to be found many light colored lice on queens and only in exceptional cases were they to be found on workers. The workers were observed to try to rid themselves of the lice and it may be that the delicate, newly emerged Braula finds a safer refuge on the queen, which seems to make no effort to dislodge them. The dark colored specimens have a hard chitinous covering and it takes a definite tug of the forceps to dislodge a specimen that has its tarsal

combs fastened in the body hairs of the bee. Live workers, put in acetic-alcohol solution with lice attached, are killed with the lice firmly adhering. When infested queens are killed in the same fashion it is found that the light colored lice are easily dislodged and the queen must be held firmly in the vial by a wad of cotton if the Braula are to be kept in place.

Beginning September 1, Mr. Nusbaum started introducing two hundred new queens. Most of the old queens removed from the colonies were badly infested with newly emerged Braula. One queen, taken September 13, had thirty-five of the little insects clustered on her, forming a veritable crust on her head, thorax and the anterior portion of her abdomen. Examination of the same colony October 20 showed that the newly introduced queen was just as heavily infested as her predecessor had been. Mr. Nusbaum is convinced that the clustering of the Braula on the queens at this season retards egg-laying and largely defeats the purpose of requeening.

Braula was far more abundant this fall than in the spring and, unless a heavy winter loss should occur, the pest will start the next season in greatly increased numbers. Mr. Nusbaum says they were more abundant in October of this year than they were a year previous, and feels that they are definitely on the increase.

Since this insect seems to have some economic importance, it is essential that its distribution be thoroughly known. It is therefore hoped that any persons having opportunity to determine whether this pest is present in various localities will communicate with the author promptly.

THE CORNELL BEEKEEPING LIBRARY

By E. F. Phillips, *Cornell University, Ithaca, N. Y.*

Abstract

A short account of the plans and accomplishments of this Library during 1925.

The beginner in beekeeping with his first observations on the activities of the bees often thinks that all knowledge of these insects resides in him and that his every observation is a marvelous discovery. On further study he learns that much is already known about the honeybee and that those who have preceded him in this field were men of great worth as investigators. To the beginner in investigation a knowledge of preceding work is vitally important. For the investigator or the beekeeper, either commercial or amateur, a library where the work of others on beekeeping may be consulted is of primary importance.

A number of institutions in the United States and Canada have attempted the establishment of working libraries on beekeeping, all of which are helpful. These libraries usually attempt to get the literature which will be most immediately helpful to those who use it, for the literature on bees is so vast that such libraries usually dare not attempt a complete collection. The working libraries are of great value, but there should be several places in the United States where every available publication on bees is collected for the use of those who desire a broad knowledge of bees and who also have a desire to know something of the history of the science and art of beekeeping. There is often not a sharp differentiation between the working library and the one which deals also with the historical side.

The establishment of the Miller Memorial Apicultural Library at the University of Wisconsin was a great step in advance in this field, as well as a worthy memorial to a great beekeeper who was loved by all who knew him either personally or through his voluminous writings. Under the active management of Prof. H. F. Wilson this Library is rapidly gaining a place of note among the beekeeping libraries of the entire world and it has deservedly had support from beekeepers of all parts of the world who are admirers of Doctor Miller.

In the establishment of the teaching of beekeeping and the training of men for research in that field at Cornell University, a need was at once felt for a library which would include not only the current literature but also as much of that of the past as can be gathered together. Work was begun on this in January, 1925, and those interested in the progress of beekeeping may wish to know something of the progress which has been made. This Library includes certain interesting features not previously attempted in similar libraries which are worthy of record. It is not the purpose of this account to advertize this Library unduly but rather to point out its special character, some points of which may be worthy of imitation in other institutions.

The Cornell Beekeeping Library is not named in honor of any one great beekeeper but rather includes a collection of memorials to a large number of those who have contributed to progress in this field. A special effort has been made to get the books and files of bee-journals which were actually used by these men, with highly gratifying results. To the end of November 1925, collections of books and journals have been received which were formerly the property of about forty early American leaders in this work, each collection being a worthy memorial to the former owner. Donations have been received from a large number

of persons interested in beekeeping progress, the accessions by gift now numbering 2058. These donations have come to the Library from 117 persons living in twenty-three States of the United States, three Canadian provinces and ten foreign countries, showing a wide interest in this effort to collect in one place our knowledge of what has been written on bees. The number of accessions by gift does not include a rather good working collection of current beekeeping literature which was on hand in the libraries of the University when this effort was inaugurated, nor does it include purchases made during the year of which there have been a considerable number.

The current literature on bees and beekeeping is obtained in two ways. The current bee-journals are being donated to the Library through the generosity of The A. I. Root Company, as a memorial to its founder, Mr. A. I. Root, through exchanges with *Gleanings in Bee Culture*. There are in the neighborhood of 140 bee-journals now being published in all countries and the list of these has been corrected and enlarged through the cooperation of the Federal Department of State. The Root Company reserves those journals published in the English language and for these other arrangements have been made. It is expected that beginning with January, 1926, the Library will receive every bee-journal published. Current books are received either by donations from the authors or by purchase from the Library funds.

In any effort of this kind it is essential that arrangements be made for the perpetuation of the Library, for obviously those now interested in such an effort will not always be able to continue such work. To insure continued effort to increase such a special library, the safest method is to establish an endowment fund which can be used for no purpose other than the object for which it is donated. With this in mind, an endowment fund is being established for the Cornell Beekeeping Library, not by soliciting direct financial contributions from beekeepers but through their cooperative labors. Each interested beekeeper is asked to dedicate one colony of bees to the Library, the proceeds from this colony to be added to the endowment fund. When the total contributions from such a colony equal or exceed fifty dollars, the Library obligates itself each year to buy one additional book from the income of the endowment fund and to mark this as the gift of the person who has completed his endowment unit. In the case of beekeepers' organizations, the dedication of colonies is not feasible and the money may be raised by any method approved by the organization. In such cases several organizations have asked that their endowment units be considered as me-

morials to formerly prominent beekeepers. The Ohio Beekeepers' Association has inaugurated a movement which will appeal to beekeepers everywhere, namely the establishment of a memorial, long delayed, to Father L. L. Langstroth. It is not to the credit of American beekeepers that they have failed for all these years to express in fitting manner their appreciation of the work of this great master, and the Ohio association feels that the time has come when this neglect shall cease. The organization has completed one endowment unit and has begun a second, with the probability of taking out several units. The Secretary of that society, Miss Florence Naile, is also urging other beekeepers' organizations to join in this memorial, and several have already expressed their intention of so doing.

The Eastern New York Association feels that it is better to show appreciation while the men are living, and they have undertaken the raising of two endowment units, one each for the two veteran apiary inspectors of New York State, Messrs. Charles Stewart and W. D. Wright. Another organization is raising a unit in memory of the celebrated New York beekeeper, Julius Hoffman. Now that the use of endowment units as memorials is established, it is proposed to go back to associations who had previously made such endowments and ask whether they also wish to make theirs as memorials.

In these various ways it is proposed to make in this Library a series of memorials to the men who made beekeeping of today what it is. By these means their names will pass on down to the knowledge of future workers in this field of labor and the appreciation for their efforts will remain green. The Library thus in a sense becomes the Beekeeping Hall of Fame, a place in which any beekeeper will feel proud to have his name recorded.

In order that the Library may not be limited in its usefulness solely to those residing in Ithaca, arrangements are made through the Library Exchange system to have all books and volumes of bee-journals available to any beekeeper anywhere through any public library. This will care for the needs of perhaps ninety-five per cent of those who may desire to borrow books from the Library. Any beekeepers who cannot have access to a public library can also obtain books by making a suitable deposit. Everything in the Library can be sent out with the exception of a few rare and unusually valuable books. For example, those books formerly owned by Moses Quinby and Dr. C. C. Miller are so valuable because of their associations that it seems best to restrict their use to those who can read them in the Library room. In all such

cases an effort is made to have a duplicate copy available for outside distribution.

It is also expected that this Library will be valuable to other colleges and universities which are collecting similar lots of beekeeping literature. Through donations a considerable number of duplicates have been received which will be valuable as exchange material or for sale. Exchanges have already been made in several cases and some sales of duplicates have been made, and as additional donations are received, more such material will be available. By cooperating, the various institutions which desire beekeeping literature can be of great aid to each other.

CHAIRMAN R. L. WEBSTER: Mr. Dunn has an exhibit of the life history of the honey bee, which may be interesting to some of you, and we will call on him for just a minute or two to give us a demonstration of that.

MR. A. H. DUNN: I wanted to show this for two reasons; first, it will interest the scientists, and second, I think it will interest the beekeepers. The company I represent prepared eight of these models several years ago to represent the life of the honey bee. It was with a great deal of difficulty that they got six of these exhibits finally in the Field Museum of Chicago. The seventh is in the public library at Chicago and the eighth at Medina, Ohio. The Field Museum uses it, of course, educationally. It is a splendid piece of educational work, for here is what will be done with the six pieces that are in the Field Museum at Chicago this year: There will over 500,000 school children in Cook County write essays on bees and honey, using this case as their background. Of course the Field Museum loans them out to the school system and the school system sees that the schools get them. The educational features are contained in these slides here which give the story. The Museum at Milwaukee is very anxious to get some of these. Almost invariably Museums are very anxious to get them.

CHAIRMAN R. L. WEBSTER: Your Secretary and myself had planned a little symposium on "Spraying and Dusting of Fruit Trees and Their Effects upon the Honey Bee."

MR. F. C. PELLETT: The opening of this subject was assigned to me. In the first place I haven't any contribution in the way of original observations. The beekeepers all over the country are complaining that the bees are destroyed from the spraying of fruit trees. During recent months I have had an opportunity to visit some of the larger

fruit growing sections of the West, including the Pecos Valley of New Mexico and the Grande Valley of Colorado. I found that what were formerly some of the best beekeeping locations, the large commercial beekeepers have practically deserted because the loss was so great through the use of sprays. We used to think if the sprays were not applied when the blossoms were open there would be no danger to the bees, and beekeepers have agitated the passing of laws which would prohibit the spraying of fruit trees while in bloom. One or two states have passed such laws. We find that that doesn't by any means solve the problem; in some of those sections, spraying has come to be practically a continuous process. I was told in the Grande Valley and the Pecos Valley that they spray from six to eight times a year in the control of the codling moth, and apparently the bees are destroyed without very much relation to the blooming of fruit trees. In some cases they get the poison from their search for water.

Men have told me that some of the best beekeeping territory was no longer available to commercial beekeepers. Near Delta, Colorado, last summer I visited an apiary I think the last week in July where they had just finished the first extracting and got an average of about sixty pounds per colony just a few days previous. At the time of my visit, the apiary was to the point where there was a big pile of dead bees in front of every colony. There was no hope of getting any more honey during that season. So we have a very practical problem of interest to both the fruit growers and beekeepers which our own scientific men will have to take up and work out, for we must find some means of controlling the codling moth and at the same time saving the bees.

MR. BAKER: I have made some observations of bees this season in western Illinois. I know of one place where beekeepers in a locality lost literally thousands of bees because the apple trees were sprayed through the bloom. We don't advocate that particular spraying but it was done because of weather conditions. In another locality a man put bees in his orchard, sprayed before the bloom, did not spray during the bloom, and put his bees in there; he took his bees out after the bloom before he sprayed again. The bees did not die at all by obtaining poison that had been put on previously. He had no mortality that he knew of.

CHAIRMAN R. L. WEBSTER: Next is open discussion on outline of program for 1926 meeting.

SECRETARY G. M. BENTLEY: There is one matter of importance. It would help the Secretary, whoever that person may be next year, to send in subjects for the Section early. Early in November all subjects of

papers and speakers have to be sent to our general Secretary, Mr. Collins. This year six papers came in after the program was submitted.

CHAIRMAN R. L. WEBSTER: I will now call for the reports of the committees.

REPORT OF THE RESOLUTIONS COMMITTEE

"*Resolved*, That in the death of Dr. W. D. Hunter all interests in entomology in the broader sense have suffered an irreparable loss in a man whose personality went far in carrying science to the farmer and commercial interests alike and whose research in economic entomology was of the highest type; therefore, be it further

Resolved, That the Section of Apiculture recognize their great loss and communicate to Dr. Hunter's family our deepest sympathy in their bereavement.

In the recent death of our distinguished and beloved President of the American Association of Economic Entomologists, Professor H. A. Gossard, this Section mourns the loss of a friend and leader in entomology; therefore, be it

Resolved, That we extend to Professor Gossard's family our heartfelt sympathy in this time of their sorrow.

Be it Resolved, That this Section go on record as favoring the extension of apicultural exhibits both by educational institutions and commercial enterprises in connection with our meetings, and that we ask the American Association for the Advancement of Science to make possible such exhibits, without expense to exhibitors, in a room contiguous to our place of meeting.

Be it Resolved, That we favor the further support by experiment stations of research in beekeeping problems and especially encourage the inauguration of investigation of marketing problems under the authority of the Purnell Act.

Be it Resolved, That it is the sense of this Section that there is need for a longer time to present papers; that the Secretary of this Section be empowered to negotiate with the officials of the Association of Economic Entomologists for arrangements of an all-day meeting of this Section in future programs."

CHAIRMAN R. L. WEBSTER: You have heard the report of the committee. What do you wish to do with it?

It was moved, seconded and carried that the report be accepted.

CHAIRMAN R. L. WEBSTER: We will have the report of the Nominations Committee by Mr. Robinson.

MR. J. C. ROBINSON: Our committee held a meeting and there was a feeling of the committee that we should pass the chairmanship of this Section around. We knew that the meeting would be in Philadelphia next year, so we felt we were doing the best thing possible in nominating for Chairman J. I. Hambleton, Apiculturist of the U. S. Bureau of Entomology, who has charge of the investigation work of the Bee Laboratory.

Most of you, I am sure, have enjoyed this meeting and all of you know that the one individual who has really put more into the Apiculture Section than any one person is our present Secretary. So our committee feels that it is imperative that Prof. G. M. Bentley be recommended as Secretary for this important Section.

MR. F. C. PELLETT: I move the adoption of the report, with the officers as named.

The motion was seconded and carried. (Applause)

ADJOURNMENT: 12:40 p. m.

A PRELIMINARY REPORT ON THE CONTROL OF WIREWORMS ON TRUCK CROPS[1]

By J. L. HORSFALL and C. A. THOMAS

ABSTRACT

During recent years, wireworms have caused much damage to truck crops in the Philadelphia area. Preliminary experiments indicate the possibility of controlling these pests successfully with calcium cyanide used as a soil fumigant. The use of a trap bait in the spring followed by an application of granular calcium cyanide before the crops were planted, gave the most promising results. Summer treatments killed many wireworms, but caused injury to cabbage and celery. Fall treatments were only partly successful, due to the depth of the insects in the soil at this time, their decreased activity, and to other factors.

During recent years, wireworms of the genera Pheletes and Agriotes have caused severe injury to beets, carrots, cabbage, celery, parsnips, potatoes and corn in southeastern Pennsylvania, especially in the intensely cultivated area about Philadelphia, where the land has been under constant cultivation for years.

The failure of the usual measures recommended to control these insects on field crops, to check them under truck crop conditions, made it necessary to try out other control methods. Accordingly, in the spring of 1923, tests with granular calcium cyanide as a soil fumigant were made on wireworms feeding on cabbage roots.[2] Since that time further tests were conducted to determine the best method of applying the cyanide, and to find out at what time of the year best control could be obtained. For the latter, treatments were made during early spring before

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[2]Journal of Econ. Ent., 17, No. 1, Feb. 1924. p. 160.

the crops were planted, in the summer while they were growing, and in late fall after all crops were harvested.

Spring treatments with calcium cyanide were made as follows:

1. Cyanide drilled into the soil after the planting of baits.
2. Cyanide broadcasted by a lime-spreader, and then plowed under.
3. Cyanide placed in plow furrow by drill, then covered.
4. Cyanide distributed by applicator attached to plow.

1. Cyanide Drilled into the Soil after the Planting of Baits

A field heavily infested with wireworms was disked and planted with sweet corn, 2½ inches deep, in rows 4 feet apart. At the time of planting (April 7), no wireworms were found in the upper seven inches of soil, but by April 25, they were present in the rows feeding on the corn. At this time, granular calcium cyanide was applied to the surface of the soil immediately above each row of corn by means of a wheelbarrow fertilizer drill. A man followed close behind with a small tractor cultivator, and worked the cyanide into the soil to a depth of three inches. Part of the field received 400 pounds per acre, the remainder 200 pounds per acre.

Diggings in the rows one hour after treatment showed a kill of from 70 to 80%, the higher percentage being found in the 400 pound plot. Diggings several days later, however, showed that many wireworms had migrated to the corn from between the rows, even though the odor of cyanide gas was still evident in the rows. This would seem to indicate that the gas did not have much, if any repellent action against the insects. It also shows, as did diggings between the rows after the latter were treated, that the application was made too soon, for many wireworms were found still some distance from the corn. The low soil temperatures which prevailed between the planting of the corn and treatment also slowed up the movement of larvae into the rows. Rows planted 2 feet apart instead of 4 feet would undoubtedly have given better results.

Plowing the soil before it is disked and planted to the trap crop would facilitate the movement of the wireworms to the corn. Small scale experiments on depth treatment of the insects in flower pots likewise show that the use of a drill which would place the cyanide at the level of or below the baits, is a much more effective method of applying the material, and reduces the amount of cyanide required.

Carrots planted later on the plots described above, showed at harvest time 2.84 per cent injury in the plot receiving 400 pounds of cyanide, and slightly more than 4 per cent injury in the plot receiving 200 pounds.

2. Cyanide Broadcasted by a Lime-spreader and then Plowed Under

In April, 1925, a one acre field was divided into four equal plots, and granular calcium cyanide was drilled upon the surface of each by a horse-drawn lime-spreader having a width of 8 feet, and with holes 8 inches apart in the bottom of the hopper. The field was then plowed 8 inches deep with a double plow drawn by a tractor. At the time of treatment wireworms were abundant in the field, about 85% of them being in the top four inches of soil. This treatment gave a kill of over 70 per cent in all plots, with the greater kill in the plots receiving the heavier dosages.

Two weeks after treatment, carrots and parsnips were planted in all four plots. The following table shows the results of treatments, the dosage given each plot, and the number of days the cyanide gas remained in the soil after treatment.

Plot No.	Lbs. of $Ca(CN)_2$ used	Last positive CN test	No. ft. of row examined	No. of carrots examined	% of carrots injured by wireworms	% of parsnips injured by wireworms
1	75	3 days	585	1730	4.39	0
2	112	5 "	612	2088	3.51	0
3	150	12 "	600	2105	3.28	0
4	250	12 "	600	2093	5.70	0

The check on these plots was a field several hundred feet distant from the above treated plots. This field which showed approximately the same number of wireworms as the treated plots, later showed about 12 per cent injury to the carrots.

This table shows that cyanide treatments considerably reduced the amount of damage. The greater per cent of injury in the 4th plot was found to be due to the migration of wireworms into it from an adjacent untreated plot. The inside rows of this plot showed approximately 2.5 per cent injury.

None of the growing parsnips were damaged by the wireworms. The seed is often eaten by them after planting, but in these plots the absence of injury was due to the killing effects of the treatments. By the time any wireworms had moved into the treated plots, the plants had reached a stage when they were apparently not attractive to them.

3. Cyanide Placed in Plow Furrow by Drill, then Covered

In this field, furrows 14 inches wide and 5 inches deep were plowed, and granular calcium cyanide at the rate of 300 pounds per acre was placed in the furrows with a wheelbarrow fertilizer drill. The cyanide

was covered at the next round of the plow. Maine Cobbler potatoes were planted ten days later. An adjoining untreated half acre was used as a check.

Counts and weighings of potatoes at digging time showed 17.2 per cent injury by wireworms on the treated field, and 37.3 per cent injury on the check. The amount of injury in the treated plot indicates that either the dosage was not heavy enough, or that the rows of cyanide were drilled too far apart. The plants on the treated field were greener and larger, indicating that the cyanide has some stimulating effect. Yields from these fields were as follows: treated field—308 bu. per acre; check—244.6 bu. per acre.

In the spring of 1925 these two fields were drilled with the same kind of beet seed at the same time. Examination during the summer showed an excellent stand of beets in the field treated last year, only five plants in the whole field dying from wireworm attack. In the adjacent field which had received no previous treatment, wireworms destroyed over 50 per cent of the stand. This would seem to indicate that the 1924 treatment so cleared up the infestation in the treated field, that there was but slight injury during 1925.

4. Cyanide Distributed by Applicator Attached to Plow

In 1924, a plot infested with wireworms was treated with calcium cyanide by means of an applicator loaned by the American Cyanamid Company. This was attached to the plow in such a manner that the cyanide was dropped just ahead of the plow blade, and was turned under at the next round of the plow. 225 pounds of cyanide per acre were applied. Double plows digging a furrow 5 inches deep, and placing the cyanide in rows 28 inches apart, were used in this experiment.

The field was planted to carrots ten days after treatment. Counts in August showed that wireworms had injured 17 per cent of the crop. The use of the applicator on a single plow would have placed the rows of cyanide closer together, and probably would have given better results.

It is interesting to note that only 5 plants out of a total of 5000 planted in this field the year following treatment were killed by wireworms.

Treatments with calcium cyanide have also been tried in summer during the growing season against wireworms attacking the roots of cabbage, and the roots and crowns of celery. The cyanide was applied around the base of cabbage plants in several different ways, and although it killed many of the insects, it also killed the plants. Summer applications for wireworms on cabbage, therefore, cannot be recommended,

though they would be of value in cleaning up a badly infested area, and thus preventing spread to uninfested portions of a field.

In the case of celery, two different methods were tried. In one series of experiments varying doses of cyanide were placed in furrows close to the plants and covered with soil. Examinations showed that a large percentage of the wireworms feeding on the outside of the roots were killed, but that dosages strong enough to kill them in the crown of the plants, were also fatal to the plants. In the second series of experiments, corn was drilled between the celery as a bait crop at various distances from the plants. Subsequent diggings showed that the corn failed to serve as a lure, the insects remaining on the roots and crowns of the celery.

In November, 1925, small plot experiments were tried in which the cyanide was placed in holes 6 to 8 inches deep, in soil containing larvae and adults of *Pheletes agonus* Say, the common destructive wireworm in the Philadelphia area. This is the depth usually attained by fall plowing. Only fair success resulted from these experiments for which the following reasons may be given: in late October the larvae of this species are moving down in the soil; by mid-November, a large number of them are below the plow line, and beyond the influence of calcium cyanide placed at that depth, especially if the soil and subsoil contain a high percentage of moisture at the time of treatment; the larvae are less active at this time, and seem to succumb less readily to the gas; many of the adults are also below the plow line, and are not attracted by baits at this time of the year. It would thus seem that fall treatments for these insects are not practical.

SUMMARY

Calcium cyanide is the best soil fumigant found thus far for the control of wireworms on truck crops.

Spring treatments have given the best control of these pests.

Of these spring treatments, drilling in the cyanide after the insects have reached a previously-planted bait crop, has been most effective.

Summer treatments of cabbage and celery are not recommended because of toxicity to such plants.

Fall treatments, up to the present, have not proved practical.

HESSIAN FLY CONFERENCE

A Hessian fly conference was called at the Hotel Baltimore, Kansas City, Mo., at 9:00 a. m., December 30, 1925, as a project of the American Association of Economic Entomologists, the following persons being in attendance:

H. M. Bainer, Orlando S. Bare, G. F. Bieberdorf, H. R. Bryson, E. I. Burton, W. B. Cartwright, J. J. Davis, Geo. A. Dean, D. M. DeLong, Carl J. Drake, W. P. Flint, A. L. Ford, A. B. Gahan, Harry L. Gui, L. Haseman, L. L. Huber, E. G. Kelly, J. W. McColloch, (Miss) Eugenia McDaniel, H. R. Painter, J. R. Parker, F. W. Poos, Philip A. Readio, Jos. A. Reeves, Raymond Roberts, A. F. Satterthwait, S. C. Salmon, Myron Swenk, R. I. Throckmorton, F. M. Wadley, Don B. Whelan, L. C. Woodruff.

Mr. Geo. A. Dean, elected to chairmanship at the Washington meeting, called the conference to order and requested nominations for chairman and secretary, explaining that he was obliged to excuse himself shortly from attendance. Messrs. J. W. McColloch and A. F. Satterthwait were nominated and elected to these respective offices.

The Chair reviewed the purposes of the Hessian fly conference, with comparing of experiences in Hessian fly survey and control the high points. Mr. McColloch stated that the Hessian fly is present in a good many regions and affecting every portion of our wheat area, hence national in character, and modified so locally that it is no less a local problem, with much work to be done. Reference was made to statistics presented at the Conference of Extension Entomologists, to the end that Kansas alone lost 20,000,000 bushels of wheat in 1924, 40,000,000 in 1925. The fly has become established in the semi-arid western portion of this State, where contrasts between wheat seeded early and at the fly-free date has made insufficiently favorable contrasts in yields to interest the farmers in appropriate cooperation, especially as forage value from the wheat planted early is lost when seeding is deferred to the fly-free date. Safe seeding date was ascertained for the north and the south portions of each county. A midsummer brood developed in volunteer wheat where there was a six-inch rain fall in a brief period of seventy-two hours. Rain from September 20 to 26 brought out all fall issuance simultaneously, but in no case infesting wheat seeded at recommended dates.

Mr. W. P. Flint reported at length concerning the Hessian fly situation in Illinois, showing regional zones of infestation ranging from less than 1% to 27.7%. In the fall of 1924, all wheat areas were heavily infested and the fly issued in the spring, furnishing a most striking demonstration of the spread of the fly from early seeded fields. The feeling was so strong by the cooperators against the early planters that plowing of the fields at night was considered. An Amish community had been influenced by the Church to plant wheat early in 1924, resulting in the loss of all wheat in this area, for members and non-members alike. In the fall of 1925, rainy weather made seeding difficult and cut the area about 50%. After infestations had been observed as 70% and 26% egg infestations, an early freeze and snow reduced these to 26% and 0% larva infestations, respectively. The reaction from reduced wheat area on account of inability to seed after the fly-free date may mean reduced cooperation in 1926 seeding.

Mr. J. J. Davis stated that conditions in Indiana were about identical to conditions in Illinois. Where September 28 was the safe date, seeding of September 14 showed 20% infestation. Eggs were abundant on wheat to the fly-free date, then the early freeze interrupted development. Many larvae are less developed than normal for the season and winter mortality will probably be higher as a result.

Mr. C. J. Drake reported that in Iowa the Hessian fly condition in 1925 was good, 80 to 100% of the farmers cooperating. The farmers asked for three fly-issuance stations, but careful surveys for infestations revealed only one area where sufficient

fly was found to merit a station. This was in the south-eastern portion and was furnished with a station. The flaxseed count system of determining the safe planting date is a modification of the codling moth survey system and gains one week in safe seeding date over the egg-count system. This project receives better cooperation than any other Iowa College project.

Mr. L. Haseman reported the fly situation in Missouri better than at any other time in the past several years and that the fly has been on the wane definitely for three years. Excessive rain at seeding time, September, 1925, resulted in a 50% reduction in wheat area, but will probably cause no unfavorable reaction in matter of cooperation.

Mr. Myron Swenk reported for Nebraska that the safe seeding date was determined from experiences from a ten-year period, 1904–1914. The fall of 1922 was unusually dry and the peak of emergence was 7 to 10 days later than normal, with result that all wheat was seriously infested. In the fall of 1923, the flaxseed examination was resorted to, after same system as that used by Mr. Drake, revising the date. The season was about normal. Cooperation was incomplete and gave strong contrasts in yields between those from seedings at safe seeding dates and at prior dates. These areas were charted and published, with seeding dates and infestations and yields. In 1924, two observation stations were maintained, one in area of greatest and one in area of least rainfall. The fall of 1924 was fairly normal with emergence greatly delayed. In fall of 1925, the two stations were opened simultaneously and in the dry area 5% and in the more rainy area 50% had issued. Cooperation was good in counties having county agents and dates for safe sowing were determined in these respective counties by the agents. A steady reduction in infestation has been accomplished.

Mr. J. R. Parker reported for Montana twenty-five to thirty flaxseeds to the wheat stem last year. No survey was made by him this year, but Mr. C. N. Ainslie visited the area twice and reported only slight infestation. The fly is in three counties next to the North Dakota line.

Mr. L. L. Huber reported Ohio conditions similar to those of Indiana. No danger is expected in northern, eastern or western Ohio, but the infestation in south-central Ohio is somewhat dangerous.

Miss Eugenia McDaniel reported evidence that many wheat farmers of Michigan depend on the safe-date as furnished by the entomologist's office, with good cooperation and only two localities infested.

Mr. H. M. Bainer reported that farmers in the southwest wheat association were cooperating to the fullest extent in observing the fly-free planting date, with reducing loss in wheat yields the last two years.

Mr. Drake mentioned two heavy delayed emergences of fly in fall of 1923. Planting was held back until safe, even though farmers were restless along part of the Iowa-Nebraska line. One farmer, three or four days too early with seeding, lost half his crop, while those observing the date, determined by watching the flaxseeds, were uninjured.

Mr. Haseman referred to cooperative work with the Federal Bureau of Entomology in determining fly-free dates through northern, central and southern portions of Missouri. For the State at large, the worst loss in recent years was in 1915–1916 crop. Since that year, losses have been local. Cooperation in the safe-date planting of wheat has been better than in any other project of the University of Missouri.

Mr. McColloch stated that in Kansas the county agents were depended upon to

have two to four experimental plats in each county, with demonstration meetings, to determine safe seeding dates and to make the results intelligible to the farmer. The cooperation in the west end of the State is weak. Some wheat seeded September 12 is completely dead.

Mr. F. M. Wadley mentioned the length of safe planting period for wheat along the south line of Hessian fly infestation in northern Arkansas as long. It was stated that the safe planting period in Minnesota is short. Mr. Flint stated that there was a great difference in length of safe planting period in Illinois between the north and the south ends, and Mr. S. C. Salmon stated that a month of safe planting period, or even more, prevailed in southern Kansas, while at Manhattan, the yield falls off rapidly with deferred date after the fly-free date has passed.

Mr. Drake made inquiry concerning a committee believed to have been appointed at the conference in 1924 for determining upon a uniform method of getting Hessian fly counts. Mr. J. A. Hyslop urged the desirability of uniform methods or methods which could be translated to a single standard. A motion was made by Mr. Drake, seconded by Mr. Haseman, that if there is no such committee, the Chairman should appoint one. The motion was carried unanimously.

The Chairman suggested the possibility of issuing a mid-winter number of the Insect Pest Survey, summarizing the winter situation of such insects as the Hessian fly, chinch bug, green bug and boll weevil. Mr. Flint endorsed the Chairman's suggestion that a resume of a few of the most important pests should occupy one particular number of the Insect Pest Survey, which suggestion was approved by Mr. Hyslop for the initial number,—February, 1926,—for which issue the survey reports should be in by January 25, 1926. The pests determined upon are the chinch bug, Hessian fly, cotton boll weevil and the San Jose scale. Such summaries were vouched for for their respective pests for Kansas, Missouri, Illinois, Indiana, Nebraska, Michigan and, except for San Jose scale, Oklahoma. Mr. Kelly requested that reports from Texas and Oklahoma on the green bug be included and Mr. L. C. Woodruff consented to undertake to report on this insect.

It was moved by Mr. Haseman and seconded by Mr. Drake that the Hessian fly conference be continued as a desirable project, and the motion was carried.

The chairman and secretary elected for this 1925 conference were nominated and elected to serve at the 1926 Hessian fly conference.

The conference then adjourned.

A. F. SATTERTHWAIT, *Secretary.*

Scientific Notes

Trigona laeviceps not a Pest. With reference to my note to JOURNAL OF ECONOMIC ENTOMOLOGY, 1925, p. 836, Dr. Hugh M. Smith now writes: "My note, as I recall it, related primarily to the smaller species, which I mistook for a bee but which you pronounce a fly. The little bee that has a tubular home is not pestilential, but on the contrary, is quite inoffensive. There are dozens of colonies about my windows and verandas." With the *Trigona*, Dr. Smith had sent a small tube of minute acalyptrate muscoids, which were preserved in liquid, and not in good condition for study. I accordingly paid no attention to them, as Dr. Smith's letter referred to bees. On getting the second letter, I made a hasty examination of the flies, and concluded that they were Chloropidae, unusual for the dark color. I then sent them on to Dr.

L. O. Howard, who replies: "The specimens have been examined by Dr. Aldrich, who finds that he cannot name them. He imagines that the insect is like *Hippelates flavipes* in our southern States in the habits of the adult. Of course you know this little fly is constantly seen about the exposed mucous membranes of human beings and domestic animals and is supposed to have been a carrier of pink eye among school children in Florida some years ago, according to H. G. Hubbard's idea." For a further account of the matter see E. A. Schwarz, Insect Life, VII, p. 374.

T. D. A. COCKERELL

An instance of severe injury by the European Horseradish webworm. Cases of serious injury by the European horseradish webworm (*Evergestis straminalis* Huebn.) in the United States have never been reported so far as the writer is aware. Hence, the following instance may be interesting. On October 1, 1925, Miss Amy Neale, Pittsburgh, Pa., wrote that turnips planted in a new piece of ground in that vicinity grew finely until toward the last of September when the foliage looked as if it had been burned. Examination showed that the caterpillar of *Evergestis straminalis*, which was sent later, had eaten the leaves and then riddled the turnips, some containing as many as four or five caterpillars. At the time of receipt of the injured turnips, many showed from 20 to 80 per cent destruction of the tissue, and in a week's time fully half of the turnips which were so infested were in a decaying condition. The larvae sometimes gouged out holes at the bases of the leaf-stalks but seemed greatly to prefer the interior of the turnips, making holes approaching galleries in their inroads. In the writer's article on this species[1] mention was made of Dr. James Fletcher having recorded severe damage by this species in the maritime provinces of Canada. Whole fields of cabbage and turnip were destroyed at Cape Breton Island and note was made of injury to cabbage heads. Available records do not show Pennsylvania as hitherto recorded for this species, although its occurrence in New Jersey near the Pennsylvania line has been observed.

F. H. CHITTENDEN,
Bureau of Entomology, U. S. Department of Agriculture

A Suggestion as to how Phytophagous Insects may ingest Powdered Poison. While conducting a series of laboratory experiments with dust mixtures against the Western Twelve-Spotted Cucumber Beetle, *Diabrotica soror* Leconte, the following observation was made. Adults were collected from potatoes and brought into the laboratory alive in test tubes and bottles. As the beetles were collected in large numbers, a considerable amount of dirt also found its way into the tubes. In walking about the beetles engaged particles of the dirt in their tarsi. That collected by the fore tarsi especially irritated them, and they were frequently seen passing their fore tarsi between their mandibles to clean them off.

Consequently a glass tube (15" x ½") was arranged so that it was connected with a test tube containing a number of beetles. The inside of the glass tube was sprinkled with lead arsenate so that the beetles had to walk over the powdered poison to escape. I watched a number of beetles make their exit down the poison laden tube. At frequent intervals the beetle would stop and first pass one fore tarsi between their mandibles and then the other, to clean the powdered arsenate from it. Several beetles were observed to pass their middle tarsi between their mandibles also, and

[1]Dept. Bul. 966, U. S. Department of Agriculture, 1921, p. 8.

one cleaned his hind tarsi with the middle tarsi and then cleaned the middle tarsi with his mandibles.

As far as could be observed there was no effort on the part of the beetle to free the arsenate from its mouth after cleaning the tarsi. Some beetles traversed the tube successfully but were noticeably sluggish toward the end of their journey. The following day 13 beetles were found dead within a radius of six inches from the tube exit and three beetles had perished in the tube before their journey was completed. Those that had not entered the poison tube were still alive and active.

JOSEPH WILCOX, *Oregon Agricultural Experiment Station*

A Preliminary Note on the Attractiveness of Acetic Acid to the Japanese Beetle. During the latter part of the season of 1924 the writer conducted certain field experiments, using large amounts of Paris green in comparison with other insecticides, to determine if possible whether the conspicuousness of certain insecticides on the foliage caused the Japanese beetle to be repelled. He was assisted in this work by W. A. Price and P. A. van der Meulen. While conducting these experiments it was observed that when Paris green was used on foliage in large amounts, the Japanese beetle was attracted. Since Paris green has a slight odor of acetic acid, this acid was tested as an attrahent. On account of the waning season only a few tests were conducted, and the results were not conclusive; they indicated, however, that this material has a certain attraction to the beetle.

During the season of 1925 O. G. Anderson assisted with this work and found that under certain conditions acetic acid attracts beetles. Many experiments were made, and the following is typical: Tests with three dilutions of acetic acid, 99 per cent C. P., were conducted simultaneously as follows:

Solution No. 1	Water 250 parts	Acetic Acid 1 part
Solution No. 2	Water 1,000 parts	Acetic Acid 1 part
Solution No. 3	Water 2,000 parts	Acetic Acid 1 part
Solution No. 4	Water Alone	

The beetles alighting on the sprayed foliage were counted for a period of 3½ hours after the solutions were applied, and removed at intervals of 15 minutes to prevent the influence or attraction caused by an aggregation of beetles. The percentage of insects alighting on the sprayed foliage was found by taking the difference between the total number alighting on the foliage sprayed with water, or the check, and the total number alighting on the treated tree, and dividing this difference by the total number alighting on the check. By thus using the counts on the check tree to represent the normal activity of the beetle and comparing these counts with corresponding counts on the treated tree in terms of percentage, the efficiency of the treatment can be readily determined. The number of beetles coming to Solution No. 4 during this period was 26. Considering this number as representing the normal activity, Solution No. 1 attracted 103 beetles, or 296 per cent; Solution No. 2 attracted 73 beetles, or 180 per cent; and Solution No. 3 attracted 118 beetles, or 354 per cent. The attraction was the strongest during the first half hour after the acetic acid was applied. The practical application of this attrahent and the proper dilution to be used are still to be worked out.

E. R. VAN LEEUWEN, *Assistant Entomologist,*
U. S. Bureau of Entomology

Corn Meal as an Attrahent to the Tobacco Bugworm, *Heliothis virescens* Fab. The value of a corn meal and arsenate of lead mixture as a budworm poison has been recognized for several years in the southern tobacco-growing region.[1] It has been known that the larvae of this insect feed more readily upon poisons mixed with corn meal than upon those mixed with other carriers. The extraordinary attractiveness of corn meal was not thoroughly recognized, however, until the season of 1925, when laboratory experiments showed that corn meal is preferred by the budworm even to its natural food.

In these experiments budworm larvae of various sizes were confined singly under glass tumblers. In the case of lot No. 1, approximately one-half the area under each inverted tumbler was covered with a thin layer of the standard budworm poison (arsenate of lead and corn meal, 1–75 by weight); and the other half was covered by a semicircular piece of fresh tobacco leaf. A larva was carefully placed in a small cleared space between the two. The larvae of lot No. 2 were confined with pieces of fresh tobacco bud leaves and kept as a control. Two hundred and seventy-one larvae were used in each lot, but in lot No. 1 eleven were discounted owing to parasitism or molting, and in lot No. 2 four were discounted for similar reasons. The number that fed upon the cornmeal mixture is best indicated by the mortality record, which is given below.

Lot No. 1 (fed poisoned meal and leaf)					Lot No. 2, control (fed fresh tobacco bud leaves)		
Percent dead each 24-hour period				Percent dead first 4 days	Percent which fed on leaves	Percent dead first 4 days	Percent which fed on leaves
1st.	2nd	3rd	4th				
53.8	36.9	6.9	2.3	100	4.2	1.1	100

F. S. CHAMBERLIN, *Assistant Entomologist*, and G. L. GARRISON, *Senior Scientific Aid, Southern Field Crop Insect Investigations, Bureau of Entomology, United States Department of Agriculture*

Eggs of Panolis flammea hatching under 75% spirits. Just I have read the note of R. H. Smith, (J. E. E. '25 p. 837) on hatching of codling moth eggs under water, and suppose that my observation on hatching of eggs of *Panolis flammea* under 75% spirits should be also of any interest to the readers of the Journal. In 1924—as we had here in the pine growth of north-west Poland a big infestation of this pine-pest, I got in the spring a lot of eggs of this moth and put a number of them into 75% spirits. The next day I was very much surprised to find in the vial not one egg but merely 1st stage larvae, which hatched and died in spirits.

S. KELER, *Entomologist*,
Bydgoszcz, Poland

ERRATA

The evergreen span worm designated as *Nepytia contracta* Walker in Journ. Econ. Ent. 18:752, 1925, should have been *Nepytia canosaria* Walker, there having been an inexplicable substitution in the specific name.

[1]Farmers' Bul. 819, July 1917, Bureau of Entomology, U. S. Dept. of Agriculture.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

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The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $2.50 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

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It is regrettable that not more eastern entomologists were able to attend the Kansas City meetings. It is certain that most of them were detained by very good reasons. It is gratifying to note that some of the absentees were able to provoke an occasional smile and that without recourse to radio, judging from the copy of the newest and perhaps the most ephemeral entomological publication which has drifted into the editor's hands. To our friends in the middle and far west, we confess that it was our loss not to be able to attend the meetings and to miss the opportunity of coming into closer touch with the aggressive work of a large and important section of this country.

The editor does not recall a meeting when so large a proportion of the papers were read by title or not presented, owing to the absence of the authors. The result is greater difficulty in assembling the proceedings and an unusually large number of papers to be held as having been read by title. It is planned to publish in the April number the symposium on parasitism given at a joint meeting of the Entomological Society of America and the American Association of Economic Entomologists. These valuable papers could fittingly appear either in the Annals or the JOURNAL and in view of the desirability of early publication, Professor Osborn and his associates have generously allowed us the privilege of publication.

The presentation of facts is an important phase of scientific work and is a major justification for exhibits. Economic entomologists are using various methods with a high degree of success—possibly no improvements can be made. A new venture is described in "Nature Trails, An Ex-

periment in Out-door Education," by Dr. F. E. Lutz, in Miscellaneous Publications No. 21 of the American Museum of Natural History. The method can be used under exceedingly varied conditions, and even if there were no obvious economic applications, it is believed that some effort along such lines would result in a more general understanding of science and scientific work and a consequent appreciation which could not but have a generally beneficient effect.

Obituary

Professor Harry A. Gossard

Harry Arthur Gossard was born at Ames, Iowa, February 7th, 1868, and his boyhood days were spent in that locality. He graduated from the Iowa State College at Ames with the degree of Bachelor of Science in 1889 and later, while serving as Assistant in Entomology at the Experiment Station carried graduate studies, receiving the degree of Master of Science in 1892. From 1893 to 1899 he was teaching in High School and Academy and in the latter year was elected Professor of Entomology in the Agricultural College, and Entomologist to the Experiment Station of Florida which position he filled till 1904 when he was elected Entomologist of the Ohio Experiment Station where he remained until his death Dec. 18th, 1925.

During all of these years he has carried his work with unfailing purpose and with a high degree of ability and success. At the Washington meeting of this Association he was elected our President for 1925 and his death during his term of service is the first time in the history of our society that our leader has been stricken while in office. His close associates know with what devotion he addressed himself to every duty and his numerous contributions to economic entomology attest his keen appreciation of the demands upon this science and his industry in the prosecution of his work. He was careful and thorough in the planning of experiments and generous in his treatment of the men who worked with him in the exacting details of investigation and in the publication of results.

With his confidence in the service that science must render to society he had also a loyal devotion to his religious faith and was an active worker in church and Sunday school and a trusted leader in the community where he lived. His real message to us should be read in his years of devoted service and with the assurance that in this service he found that joy of achievement which is to be counted a major satis-

faction of life. In his death the science of economic entomology has lost a distinguished leader, the state has lost a trusted and faithful servant and his associates have lost a sincere, devoted friend.

HERBERT OSBORN

MEMORIAL SERVICE

Thursday Afternoon, December 31, 1925, 1:50 p. m.

SECOND VICE-PRESIDENT LEROY CHILDS: In memory of President Gossard, some of the members of our Association suggested that we hold a short memorial service. Five people who were personally acquainted with Professor Gossard have been asked to speak very briefly relative to the many pleasant things they knew of our late President. The first who will be called upon is Dr. Ball, who will speak of Professor Gossard in the Home.

MR. E. D. BALL: Mr. Chairman and Members of the Society: It was my privilege in connection with organizations to be in the Gossard home at Ames, Iowa, a great deal. A little later, almost through an accident, Professor Gossard and myself became the owners and operators of an academy in Iowa, an academy that had been a denominational school and had been turning out a large number of preachers and teachers in other institutions.

We took up the work of this academy together; we boarded together; we roomed together; we worked together. We were the only two male members of that faculty. When it came to dividing up the offices of the institution, we had to have a president and a janitor. The president had to preside over the chapel and lead chapel exercises. It had been the custom of the president of the institution to preach in the local church. Professor Gossard was, naturally, the president of the institution. I was, just as naturally, well fitted to be the janitor and handle the business arrangement and look after all those parts of it, to see that the institution ran in other lines than the religious and educational.

As I look back on those days, I think I see right there the beginning of what was the unfortunate end. We were remarkably successful for a little, struggling institution and made some money, enough money so that I went back and finished my work in college on the strength of that year's work there.

During that time and even before that time Professor Gossard was never young, he was always old, he always carried the burdens. He was always thinking of other people.

His attitude in the home with his brothers and sisters and mother was

W. A. Gossard

wonderful; he was charming, obliging, considerate, loving, and my relationships with him in the boarding house, in the room and in the school were all of the same kind, but at night after we should have gone to bed, I have known him time and again, day in and day out, week in and week out, pace up and down the little double room that we had, the sleeping room and study, thinking, studying, planning, worrying about that institution, and it was running well; I was supposed to be running that end of it myself. He couldn't get that off his mind.

He was too conscientious; he went into too much detail; he thought too much about other people. He was probably a little too ambitious in certain ways and he couldn't let down and get those things off his mind and play; he never played, but as a worker, as a friend, as a teacher, as a preacher, he was wonderful, charming, convincing, successful.

Others of you know features of his life, but I just wanted to leave with you that rather inside glimpse of Gossard as I knew him in his younger days, even then a man who would be considered old in his attitude toward life and his attitude toward responsibility.

SECOND VICE-PRESIDENT LEROY CHILDS: Professor Flint will speak to us on the subject: "In Cooperation with President Gossard."

MR. W. P. FLINT: Mr. Chairman and Members of the Society: It was to me, as it was to all of you, of course, a very great shock when I learned of President Gossard's death. I learned of it at my office one morning. I had read something of it in the paper, and in thinking it over that day, I thought that those of us who are in entomological work in Illinois had lost a friend, and that the state also had lost a friend, because in all of the work that we had been doing in Illinois, we always felt very free to call on the people in Ohio if we knew that they were carrying on any work along the same line.

If we wanted some information on a piece of work that Professor Gossard or one of the men working with him had started, maybe this year or maybe last year, something that they contemplated would run as a three-year or five-year term and which had not been published, all we had to do was to write for the information and we would get the accomplishments they had made to date, and I think hardly ever with the line added, "This work has not been published and we request that you not say anything about it outside." Of course that was understood. That just shows the type of cooperation which he was willing to give from the work under his direction. I think that was one of the biggest things in his work; it certainly was in this matter of helping those in other states, and his sole idea, of course, in that was not to get

credit but to do everything he could to advance a piece of work, feeling that the work was far bigger than any of the men connected with it, as we must feel about all of our work.

I think we can take Professor Gossard's work as an example of something to be followed and something that is going to help all of us in pushing work ahead if we adopt that attitude.

He was one of the men chiefly instrumental in forming the North Central States Entomologists, which was a cooperation of the men in the North Central states of the Mississippi Valley; he had always taken the greatest interest in that work and had always attended those meetings himself and had always made it possible for several members of his staff to attend.

This feature of his work is certainly one that we must all value very highly.

SECOND VICE-PRESIDENT LEROY CHILDS: International Relations, Mr. Arthur Gibson.

MR. ARTHUR GIBSON: Mr. Chairman, Ladies and Gentlemen: Dr. Swaine, Professor Caesar, Mr. Crawford and myself traveled from London, Ontario. When we reached here Monday morning, one of the first things we heard was of the death of Dr. Gossard. None of us had heard it, and it was a great shock to us indeed.

I do not know that any of our Canadian entomologists were particularly intimate with Professor Gossard, but in my association with the department over a number of years I had had a great deal of correspondence with him from time to time and our members appreciated the help we received from him. I think it was at the Chicago meeting that I first had the pleasure of meeting Professor Gossard. At that time we were able to discuss certain phases of the work which were of common interest and in the years following I always looked forward to seeing him at the annual gatherings of the Association. We looked forward, too, to his publications which reached us from time to time, and I can honestly say that the work which he carried on in Ohio was of direct benefit to our men in Canada.

We shall certainly miss him not only as an entomologist but also as a friend and as a man.

SECOND VICE-PRESIDENT LEROY CHILDS: In relationship of Chief and Assistant, Mr. J. S. Houser.

MR. J. S. HOUSER: Were I to be asked to designate the most outstanding attribute of Professor H. A. Gossard's professional character as brought out in the twenty years it was my privilege to call him Chief,

without a moment's hesitation it would be his utter lack of consideration for himself, and his fatherly, kindly care of those in his department. Not only did this apply to financial matters but in giving full credit for work accomplished.

The scarcity of publications bearing Professor Gossard's name during recent years has not been due to inactivity but to his willingness to perform the humdrum, the uninteresting duty in order that others might not be hampered in the execution of their problems.

In his community he was known as a tried and tested man of God and this simple statement will suffice for his personal character.

I am sure that all the members of his department will join me when I say Professor Gossard was a Chief among chiefs, loved, honored, respected.

SECOND VICE-PRESIDENT LEROY CHILDS: As Professor and Student, by Dr. Herbert Osborn.

DR. HERBERT OSBORN: Mr. Chairman and Members of the Society: I presume that I knew Professor Gossard for a longer period than any other member of the society. I first came in contact with him when he was a student in college and was attracted to him as a bright, earnest, young fellow, who showed at a pretty early stage in his career that he had an interest in natural history.

A few days ago, at the request of your President, I attended the funeral at Wooster, Ohio, and witnessed the beautiful, simple ceremonies that attended his going to the last resting place, so I have known him for many, many years, and I can testify most heartily to his solid character.

As a student he was, as I said, earnest and interested, a very faithful and careful worker. Dr. Ball has indicated some of his characteristics in his early days. I think that while he may have been very much devoted to his work, his work was done to a large extent with joy in the service, with a cheerful and willing attitude, so I do not feel that we need think of Professor Gossard in any way as having a sad or a despondent mind. As I knew him and have known him for many years, he was cheerful and his great desire seemed to be to render the greatest possible service to the men with whom he came in contact and to the people who depended upon him for service.

He was elected, at the time of his graduation, to be my first assistant in entomology at the Iowa Experiment Station. I think perhaps he was one of the first in the country to occupy the position of assistant in the entomological work of an experiment station; there were few other

stations in which the work had reached the stage where assistants were employed.

I recall particularly the interest with which he attacked his first problem, the problem which was taken up in part as a graduate study and in part as an experimental problem to be worked out for the benefit of the station. It was the study of the clover seed caterpillar and it was with a great deal of interest that I watched his reaction to the results of that study, especially when he came in contact with certain habits and certain steps of development that did not agree exactly with the statements found in the meager reports that had been given upon that insect. He followed it for two seasons, I think, with great care. He found a number of things which were different from what had been reported before, and in all of that work he seemed to show the most open mind and a desire to get at the truth and not to be bound down or influenced unduly by any authority that he might have found in any previous work. He appreciated the work done before and used it with great consideration, but I think he did not have that attitude of mind which would shut one off from discovering new features.

After his work in the Iowa Station, he went into the school work which Professor Ball has mentioned, in which he had great success. After that, I think on account of an opportunity coming from Florida, he was elected entomologist to the Florida Experiment Station and occupied that position for a number of years; then, when there was a vacancy in the Ohio Experiment Station, he was elected to take the position there, which he filled until the time of his death. In all of these positions I feel that he has rendered the most conscientious service. His first thought was of how he could best benefit the people who were dependent upon him or who looked to him for service in entomological work. I feel that in those years he had a cheerful spirit and a willingness to assist others and to always do his best.

Dr. Ball says that he never played, but I think he had an appreciation of humor and a sense of humor and that he enjoyed life; I do not want to think of him as a man who did not have pleasure or joy in his work. I don't think Dr. Ball intended to carry that idea at all. I want to think of Harry Gossard as a man who took his work in life seriously, but at the same time did it with a joy and that his accomplishments were the result of earnest, cheerful desire to carry his part in the world's work.

He had, it seems to me, a distinct faith in the fundamental value of the work he was in. I think he had courage in the struggle to replace ignorance with knowledge of the truth and that he had confidence to put in

his time and to work with the best of his energy throughout his life, which has been all too short, but which, I feel, we can look at with a great deal of satisfaction as representing the work of an earnest, honest entomological student.

Current Notes

Dr. Wm. A. Riley, St. Paul, Minn., was elected President of the Entomological Society of America at the Kansas City meeting.

Mr. Henry W. Wenzel, a student and collector of Coleoptera, died at his home in Philadelphia, November 7, 1925, aged 68 years.

According to *Science*, Dr. H. M. Parshley of Smith College has been promoted from an associate professorship to a professorship of zoology.

Mr. Norman Criddle of the Canadian Entomological Branch was honored on December 1, by being elected president of the Ottawa Field Naturalists' Club.

According to *Science*, Dr. William D. Funkhouser, head of the Department of Zoology at the University of Kentucky, has been made dean of the graduate school.

Dr. L. O. Howard, Chief of the Bureau of Entomology, and Dr. F. E. Lutz, of the American Museum of Natural History, recently visited the Boyce Thompson Institute for Plant Research.

Prof. Stephen Bruner of the Agricultural Experiment Station, Santiago de las Vegas, Havana, recently visited Washington to examine the collection of insects in the U. S. National Museum.

Mr. Frank R. Mason of Philadelphia, recently visited the Division of Insects, U. S. National Museum, and examined the collection of beetles, including those belonging to the families Cerambycidae and Buprestidae.

Prof. P. J. Parrott, Geneva, N. Y., Dr. Alvah Peterson, Riverton, N. J., and Drs. Philip Garman and W. E. Britton, spoke before the annual meeting of the Connecticut Pomological Society at Hartford, December 17.

During the past season, 951,000 adults of *Habrobracon brevicornis* and 36,700 adults of *Exoristes roborator*, introduced parasites of the European corn borer, were liberated in the infested districts of southern Ontario.

Dr. F. Materna of Vienna, Austria, and Dr. Albert Hartzell of the Boyce Thompson Institute, Yonkers, N. Y., and Mrs. Hartzell, were recent visitors at the Gipsy Moth Laboratory, Melrose Highlands, Mass.

On account of the congestion at the Japanese Beetle Laboratory, Riverton, N. J., additional space has recently been rented which will serve as a headquarters for certain phases of quarantine and research work.

Prof. T. D. A. Cockerell is president of the Southwestern Division of the American Association for the Advancement of Science, the annual meeting of which will be held at Tucson, Ariz., February 15–18, 1926.

Dr. E. P. Felt on January 8, gave the first lecture in a course of 12 free public lectures at the New York State Museum at Albany. His subject was Social Life Among the Insects.

Mr. Alan S. Nicolay of New York recently spent a few days looking over the collection of beetles in the U. S. National Museum, being especially interested in those belonging to the families Buprestidae and Carabidae.

Dr. W. E. Britton has recently been appointed a director of the New Haven (Conn.) Public Library, by the newly elected Mayor John B. Tower. On January 7, Dr. Britton addressed the Massachusetts Fruit Grower's Association at Worcester.

Dr. Vernon Kellogg, secretary of the National Research Council, gave the public address before the Entomological Society of America at the recent meeting at Kansas City, December 30. His subject was Co-operation or Isolation in Science.

Mr. R. F. Sazama, Bureau of Entomology, who has been assisting Dr. Lathrop in blue berry maggot work at Harrington, Me., has been temporarily sent to Vincennes, Ind., where he will assist Dr. B. A. Porter in fruit insect investigations.

The spread of the Japanese beetle during the summer of 1925 has been the smallest in proportion of any year on record. In Pennsylvania only one beetle was found in the open beyond the present quarantine limits.

Mr. A. W. Young, who has been in the service of the Bureau of Entomology since October, 1913, associated with the gipsy moth and brown-tail moth projects, has tendered his resignation and is to live in Florida.

In the latter part of October, Dr. E. A. Back of the Bureau of Entomology was the guest of the International Fumigators of Buffalo, at the fumigation of a large modern milling establishment at Detroit. Chloropicrin gas was used.

Plans are now under way for the transfer of the main Mexican bean beetle laboratory of the Bureau of Entomology from Birmingham, Ala., to Columbus, Ohio. Mr. N. F. Howard, in charge, will be located at the Ohio State University.

Mr. Howard Baker, Junior Entomologist, who has been associated with E. H. Siegler, at Sligo, Md., in connection with insecticide investigations, has resigned from the Bureau of Entomology to accept a position with the American Cyanamid Company, with headquarters in Florida.

Recent resignations from the Bureau of Entomology have been announced as follows: T. W. Allen, Truck Crop Insect Investigations; Howard Baker, Fruit Insect Investigations; S. M. Dohanian and A. W. Young, gipsy moth work; the temporary appointment of M. P. Jones, Truck Crop Insect Investigations, has been terminated.

The following temporary employees at the Entomological Branch, Canadian Department of Agriculture, have terminated their engagements: J. E. Revel, Lethbridge, Alberta; A. R. Graham, Fredericton, N. B.; Harold Fox, Chatham, Ont.; A. J. Graham, Vineland, Ont.; R. M. White, Treesbank, Man.; W. J. Rose, Lethbridge, Alberta; N. J. Atkinson, Saskatoon, Sask.

Dr. George W. Martin, Chief of the Biology Department of Washington and Jefferson University, returned to that institution September 17, after conducting a detailed study of the relationship of the Japanese beetle to the transmission of brown-rot of stone fruits, at Riverton, N. J.

The result of the recent ballot for officers of the Entomologists Group of the Professional Institute of the Civil Service of Canada for the year 1925–26, is as follows: President, L. S. McLaine; Vice-President, H. G. Crawford; Secretary-Treasurer, W. N. Keenan; Delegates, Arthur Gibson and J. M. Swaine; Alternate Delegate, C. B. Hutchings.

Dr. A. L. Melander, head of the department of zoology and entomology at the Washington State College and Experiment Station, has resigned to accept a position at Columbia University.

Dr. R. L. Webster, entomologist of the North Dakota Experiment Station and professor of Agricultural Entomology in the College has been appointed to a position at the Washington College and Station *vice* Dr. A. L. Melander, resigned.

Mr. S. M. Dohanian resigned from the Bureau of Entomology on September 30, 1925, to accept a position with the American Cyanamid Company of New York. Mr. Dohanian has been connected with the gipsy moth work of the Bureau since July, 1917, except for two years of service in the Army.

The following recent appointments to the Bureau of Entomology have been announced: Daniel D. Ewing, Jr., New Orleans, to study the abundance of the sugar-cane moth borer along the Gulf coast; R. H. Painter, collaborator, cottonhopper investigations; O. R. Deen, temporary, Truck Crop Insect Investigations; S. E. Flanders, agent, Saticoy, Cal.; H. H. P. Severin, collaborator, Berkeley, Calif.

Mrs. Doris H. Blake of the Bureau of Entomology has returned to Washington after an extended European trip, a large portion of which was devoted to the comparison of entomological specimens in the various European Museums. Upon her return to this country, she visited the Museum at Cambridge, Mass., where additional work was undertaken.

Dr. Alvah Peterson of the Bureau of Entomology visited the Fort Valley, Ga., laboratory on November 12 and 13 to familiarize himself with peach-insect problems in the South. He was especially interested in the life-history and habits of the Oriental peach moth under southern conditions, since he has studied this pest in New Jersey.

Mr. D. E. Fink has been transferred from Riverton, N. J., to Philadelphia, Pa., and is located at the University of Pennsylvania, where adequate facilities have been offered for the conduct of his work. He is undertaking fundamental research on the physiology of insects, including studies to determine the factor influencing the effectiveness of various poisons against wireworms.

A three-day conference of Branch officers of eastern Canada was held at Ottawa, November 30–December 2, at which many important matters pertaining to the work of the Entomological Branch were fully discussed. Dr. J. H. Grisdale, Deputy Minister of Agriculture and Dr. A. T. Charron, Assistant Deputy Minister, were present on the opening day of the conference and gave short addresses.

Mr. Walter Carter of Twin Falls, Idaho, recently visited Riverside, Calif., to discuss the sugar-beet leafhopper problem with Dr. Carsner. Both proceeded to Berkeley, Calif., for a conference with the officials of the Department of Entomology of the University of California regarding work to be undertaken on this problem. Heavy losses have been suffered by California growers during the past year.

According to *Science*, Prof. F. L. Washburn of the University of Minnesota will give up University work in July, 1926, having reached the age of retirement after 24 years of service with the institution, 15 of which he was State Entomologist. At present Prof. Washburn is collecting insects for the University in the Tuamotu Archipelago and the Society Islands of the Southern Pacific.

The following entomologists visited the Department of Entomology, Kansas State Agricultural College, after the Kansas City meetings: L. O. Howard, A. Gibson, J. M. Swaine, H. G. Crawford, Raymond Osburn, A. B. Gahan, J. S. Houser,

J. R. Parker, T. H. Frison, and G. M. List. Dr. Howard gave an address before the Science Club on Biological Control of Insects, and also talked to the advanced classes in Medical Entomology and Parasitology.

Dr. J. L. King of the Japanese Beetle Laboratory, Riverton, N. J., returned to Ohio State University in September to undertake graduate studies; Mr. E. A. Richmond of the same Laboratory recently sojourned at the Massachusetts Agricultural College, where he is continuing graduate work and doing some special work on agents attractive and repellent to the Japanese beetle. Both returned to Riverton, January 1, 1926.

At the request of the Ordinance Department of the Army, Dr. R. T. Cotton of the Bureau of Entomology on October 2 supervised the fumigation of 450,000 cubic feet of space at the Reserve Supply Depot at New Cumberland, Pa. Clothes moths destroying the felts of thousands of crated steel army helmets were the object of attack.

Dr. F. H. Lathrop, who has been in charge of the Bureau's investigation of the blueberry maggot, with headquarters at Harrington, Me., has been temporarily assigned to Sanford, Fla., where he will give attention to insect damage to the huckleberry and the blueberry, and make investigations in connection with the celery leaf-tyer work under way at that place, in co-operation with Dr. E. D. Ball and others.

Recent visitors to the Division of Insects, U. S. National Museum, are: Dr. Francis M. Root, Johns Hopkins School of Hygiene, Baltimore, Md.; Dr. John Harper, U. S. Naval Academy, Annapolis, Md.; John D. Sherman, Jr., Mt. Vernon, N. Y.; Dr. W. J. Holland, formerly Director, Carnegie Museum, Pittsburgh, Pa.; Dr. Joseph Bequaert, Harvard Medical School, Cambridge, Mass.; Dr. H. M. Loomis of the National Canner's Association; Mrs. E. W. Rorer, Ecuador.

The extermination and control work which has been carried on at Milton, Pa., in an effort to stamp out an infestation of Japanese beetles found there in 1924, was recently ended for the season. No beetles have been found at that point this year. This infestation seems to have been completely eradicated, but work will be continued at this point for another year or two, in order to make certain that no beetles have escaped.

Mr. C. K. Fisher, Bureau of Entomology, is taking graduate work for the degree of master of science at the Riverside Branch of the University of California. His work is under the direction of Professors H. J. Quayle and H. S. Smith, and is based on a study of the life history and economic importance of two parasites of the southern cowpea weevil, *Bruchus quadrimaculatus* Say. The parasites are *Lariophagus distinguendus* (Foerst.) and *Aplastomorpha calandrae* (How.).

In a shipment of umbrella ribs and frames received from Germany by a Toronto umbrella factory, a heavy infestation of two species of beetles, *Necrobia rufipes* and *Dermestes vulpinus* were found. Mr. C. H. Curran, in charge of stored products insect investigations, at Ottawa, visited Toronto October 22–27, and arranged for the entire shipment to be subjected to superheating. While in Toronto, Mr. Curran examined the insect collections at the Royal Ontario and Provincial Museums.

Mr. Louis Thiel, of San Sebastian, Guatemala, visited the Division of Insects, U. S. National Museum, in October and left some interesting specimens which he had collected. Mr. Thiel formerly lived in Washington, but for six or seven years has been living in Guatemala, and believes that it is not only a very healthful, but a

very delightful place in which to live. Insects can be collected every day in the year and the climate is delightful.

Mr. Emil L. Liljeblad, of the Field Museum of Chicago, spent four days in the latter part of October studying beetles in the collection of the U. S. National Museum. Mr. Liljeblad was especially interested in beetles of the family Mordellidae and is preparing a revision of the North American species of this group. He examined the material in the National Collection and was especially interested in John B. Smith's types.

At the recent meetings of the American Society of Naturalists and the Society of American Zoologists at New Haven, Conn., December 28–30, 1925, the following entomologists were present: Dr. Thomas E. Snyder, Bureau of Entomology, Washington, D. C.; Professors William Morton Wheeler and Charles T. Brues, Bussey Institution, Forest Hills, Mass.; A. E. Emerson, University of Pittsburgh, Pittsburgh, Pa.; Dr. Frank E. Lutz, American Museum of Natural History, New York, N. Y.; Messrs. Philip Garman, R. B. Friend and W. E. Britton, Agricultural Experiment Station, New Haven, Conn.

Mr. J. E. Graf, in charge of Truck Crop Insect Investigations of the Bureau of Entomology, recently returned from a short trip to Florida. At Gainesville he conferred with Dr. Newell and other officials of the State Plant Board. At Sanford he met Dr. Ball, Dr. Lathrop, Mr. Foster, Mr. Boyden, and others interested in the control of the celery leaf-tyer, and plans were discussed for the control of this injurious insect and serious menace to the celery industry in Florida. He also conferred with Mr. Boyden regarding the work in Florida for the eradication of the sweet-potato weevil.

Mr. Lewis B. Woodruff of New York City and Litchfield, Conn., died of typhoid fever at Torrington, Conn., November 2. His natural history and scientific collections have been left to the American Museum of Natural History. He willed $10,000.00 to the New York Entomological Society, the income to be used by the Society for publishing technical illustrated monographs. Yale University was named residuary legatee, to further the interests of its Museum. Mr. Woodruff was a collector and student of insects, particularly of Odonata, and of treehoppers, and in recent years described some new species and varieties in the latter group.

Mr. C. P. Clausen, Bureau of Entomology, writes from Shillong, India, that the outlook is most promising for the finding of parasites of *Popillia* in that region. He states that he has already found a species of *Tiphia* occurring in August on second-stage larvae, which, if it could be introduced into the United States, would probably be an exceedingly effective parasite. Up to the present time importations have been made from Japan of species of *Tiphia* occurring in the spring and in the autumn, but until the present report from India was received, no findings have been made of a species occurring in midseason.

Recently the following entomologists from foreign countries visited the Bureau of Entomology, for the purpose of studying its methods of organization and research, particularly their possible application to problems existing in their own countries: Dr. Stephen Soudek, Assistant Professor of Zoology in the University of Brno, Czechoslovakia; Dr. V. V. Nikolsky, of the Moscow Tropical Institute, and Professor Kota Monzen of the Imperial College of Forestry at Morioka, Japan. Mrs. O. A. Merritt Hawkes of Birmingham, England, also visited the Bureau, as did Dr.

H. B. Johnston of the Wellcome Laboratories of Khartoum, Sudan, who visited the different entomological laboratories in the United States and Canada, in order to become familiar with the methods of propagating parasitic insects.

Messrs. B. L. Boyden of Tampa, Fla., and W. H. White of Washington, D. C., recently attended a conference at Sanford, Fla., called by Dr. Wilmon Newell, State Plant Commissioner and Director of the Florida Experiment Station, to discuss problems relating to celery culture in Florida. Preliminary plans were made with representatives of the Bureaus of Chemistry and Plant Industry, U. S. Department of Agriculture, and officials of the Florida Experiment Station and State Plant Board for co-operative work on the leaf-tyer problem. En route, Mr. White stopped at Savannah, Ga., where he conferred with J. O. Clark, of the Bureau of Chemistry, in regard to some contemplated co-operative experiments on arsenical residues on celery sprayed for leaf-tyer control.

The meeting of the Cotton States Entomologists was held at Atlanta, Ga., February 3 and 4. W. E. Hinds is Chairman and G. M. Bentley, Secretary. The following program was presented: Wednesday, February 3 at two o'clock: Report by Committee on Policy, Dr. W. E. Hinds, Baton Rouge, La.; Dispersal Habit of the Cotton Boll Weevil, Dr. F. A. Fenton, Florence, S. C.; Cotton Boll Growth in Relation to Boll Weevil Injury, E. W. Dunnam, Florence, S. C.; Boll Weevil Control Results for 1925, Dr. W. E. Hinds, Baton Rouge, La.; Dusting Machinery, B. R. Coad, Tallulah, La.; Thursday, February 4, at two o'clock: The Potato Tuber Moth in the East, Dr. Herbert Spencer, Baton Rouge, La.; Why Not Eradicate the Argentine Ant?, Prof. R. W. Harned, A. & M. College, Miss.; Cotton Aphis Control, Dr. W. E. Hinds, Baton Rouge, La.; Present Status of the Camphor Scale, Dr. H. K. Plank, New Orleans, La.; Controlling the Mexican Bean Beetle, Dr. Neal F. Howard, Birmingham, Ala.; Latest Control Information on Peach Insects, Oliver Snapp, Fort Valley, Ga.

Last spring Dr. Wm. Schaus carried on a successful campaign to raise the money for the purchase of the Dognin collection of Lepidoptera for the National Museum. Mr. Dognin, a well-known French lepidopterist, offered his collection for $50,000. This amount Dr. Schaus succeeded in raising, largely among his personal acquaintances. In the early summer he went to France, accompanied by Mr. J. T. Barnes as assistant, and they personally attended to the packing of the collection, which reached the National Museum in good condition in September. It contains about 82,000 specimens of butterflies and moths, among which are types of about 3,300 species, nearly all American. This is the second notable addition to the division of insects within the year, the first having been the late Colonel Thos. L. Casey's large collection of Coleoptera. These collections represent the life work of two distinguished entomologists and are the greatest additions which the division of insects has ever received since its establishment, except the gifts of Dr. Schaus himself.

All the scouting work planned for the fiscal year 1926 in the Vermont portion of the Barrier Zone strip has been completed, with the exception of the township of Burlington, which will be scouted during the winter months, and the township of Essex, which is being scouted at the present time. No new egg-clusters were located, and the infestations found at Alburg, Charlotte, Ferrisburg, Fairfield, Salisbury, Castleton and Bennington in the fiscal year 1924, and those located at Leicester, Benson, and Pownal, in the fiscal year 1925, have apparently been cleaned up, no new egg-clusters being located in this scouting season in any of the previously-infested towns

just mentioned. Danby, Fair Haven, and Essex, Vt., are reinfested this year, single infestations being located at Danby and Fair Haven. The scouting around the infestation at Essex has not been completed, but there will very likely be more than 100 new egg-masses at this colony. Only a small proportion of the work planned in the New York, Massachusetts and Connecticut portion of the Barrier Zone for the fiscal year 1926 has been completed.

Dr. J. M. Swaine of the Canadian Entomological Branch, returned to Ottawa, November 9, after visiting the western laboratories and attending a special conference of western forest entomologists in California. Owing to marked differences in results obtained from bark-beetle control work in British Columbia and the western United States, Dr. Swaine and Mr. Ralph Hopping visited the bark-beetle control area in California and southern Oregon where the control methods employed and the results obtained were discussed with officers of the U. S. Bureau of Entomology and the Forest Service. A preliminary meeting was held with Messrs. Miller and Burke at the Western Forest Insect headquarters in Palo Alto, Cal. Special attention was devoted to the control areas at North Fork, Cal., and Klawath Falls, Ore. Through the kind co-operation of Mr. Miller, Dr. Burke, Mr. Patterson and their assistants of the Bureau, Mr. Jaenicke of the Forest Service, and Prof. Chamberlin of Coravillis, much valuable information was obtained that will aid Canadian officers in their work in British Columbia. Dr. Swaine and Mr. Hopping attended a meeting of the California Entomological Society in San Francisco, and visited Drs. Blaisdell and Van Duzee. They also visited Drs. Van Dyke and Essig at Berkeley, and Prof. Doane at Palo Alto.

Mr. Charles Walter Minott of the Gipsy Moth and Brown-tail Moth Investigations, Bureau of Entomology, died at his home in Melrose Highlands on the morning of November 28. He was on duty November 10, with three other members of the Gipsy Moth force. They had just completed the observations at one of the "observation points" in Marshfield, Mass., and had returned to their car, when Mr. Minott's companions noticed that he was having difficulty in putting on his coat. He could not speak, and his right side seemed paralyzed. He was helped into the car and rushed to a physician in Brockton, who advised moving him at once to his home at Melrose Highlands. Although he was conscious at times, he never spoke again. Mr. Minott was born at Westminster, Mass., April 1, 1859. He graduated from the Massachusetts Agricultural College with the class of 1883, receiving the degree of B. S., and was connected with the Vermont Experiment Station at Burlington for several years. He has been associated with the Gipsy Moth work most of the time since 1892, and with the Bureau of Entomology since October 3, 1911. Since the time of his appointment with the Bureau he has been particularly interested in the various factors causing natural increase or decrease of the gipsy moth in the field. He also made some special investigations on the effect of the gipsy moth infestations on cranberry bogs, publishing his results in 1922. He was an active member of the American Association of Economic Entomologists, and presented at the 1924–25 meetings of this association a very interesting paper on Some Results of the Defoliation of Trees, prepared by himself and I. T. Guild, of the Gipsy Moth Investigations. Mr. Minott was a clean-living and lovable man. His associates have lost an affectionate friend, and the moth work one of its oldest members, both in years and in length of service.

The sixty-second annual meeting of the Entomological Society of Ontario was

held in the Exhibition Room of the Entomological Branch, Ottawa, November 27–28, with more than sixty in attendance. The public address on Some Insects and Entomologists, was given by Dr. W. E. Britton, New Haven, Conn., at the Normal School, Ottawa, on the evening of November 27, with Dr. J. H. Grisdale in the chair. The address was followed by a smoker held at the University Club. The following papers were presented at the meetings by officers of the Entomological Branch Staff: The Oriental Peach Moth in Canada and Notes on the Yellow-striped Oak Caterpillar, by Mr. Arthur Gibson; Forest Insect Conditions in Newfoundland, by Dr. J. M. Swaine; The Canadian National Collection of Insects, by Dr. J. H. McDunnough; A Preliminary Announcement on the Outbreak of the European Shoot Moth, by Mr. L. S. McLaine; The Gipsy Moth Situation in Quebec, by Messrs. L. S. McLaine and S. H. Short; An Appraisal of the European Corn Borer Investigations as Carried on by the Entomological Branch, by Mr. H. G. Crawford; Derris as an Insecticide, by Messrs. A. Kelsall, J. P. Spittall, R. P. Gorham and G. P. Walker; Controlling the Brown-tail Moth in Nova Scotia, by Mr. F. C. Gilliatt; Lubricating Oil Sprays, and The Control of the Grape Berry Moth, by Mr. W. A. Ross; The Identification of Adult Lepidopterous Insects Attacking Stored Products, and The Distribution in Canada of a European Scavenger Fly, by Mr. C. H. Curran; Some Impressions, Entomological and Otherwise, in Relation to Prince Edward Island Agriculture, by Mr. A. G. Dustan; Some Notes on *Bucculatrix canadensisella* Chamb., and Insects of the Season, District No. 1, Ottawa (by title), by Mr. C. B. Hutchings; Insects Affecting Shade Trees on the Prairies, by Mr. J. J. de Gryse; A Preliminary Revision of Some Charopsinae, a Subfamily of Ichneumonoidea or Ichneumon Flies (by title), by Mr. H. L. Viereck; The Spread and Degree of Infestation of the European Corn Borer in Ontario in 1925, by Mr. W. N. Keenan; Notes on Mosquitoes in the Ottawa District, by Mr. C. R. Twinn; Recent Developments in the Introduction of Parasites of the European Corn Borer, by Mr. A. B. Baird; Studies of the Clover Leaf Curculio, by Mr. H. F. Hudson; Parasites of White Grubs and June Beetles in the Hemmingford District, by Mr. G. H. Hammond; Some Insects Found on Imported Plant Products Entering Canada by Rail and Road, by Mr. R. W. Sheppard; and The Rose Scale in British Columbia, by Mr. W. Downes. Among those who attended the meetings from outside points in addition to Branch officers, were: Dr. W. E. Britton, New Haven, Conn.; M. C. Van Duzee, Buffalo, N. Y.; Dr. E. M. Walker and Dr. Norma Ford, Toronto University; Prof. J. K. Breitenbecker, McGill University; Professors L. Caesar and A. W. Baker, Ontario Agricultural College, Guelph; Dr. A. B. Klugh, Queens University; Dr. J. D. Detwiler, Western University, London, Ont.; Geo. Maheux, Provincial Entomologist, Quebec; A. N. Bigelow, Royal Ontario Museum of Zoology, Toronto; Frank Morris, Peteborough, Ont.; and Chas. McNamara Arnprior, Ont.

Apicultural Notes

The University of Wisconsin offered a short course in beekeeping from January 5 to February 7, inclusive.

The Michigan State College of Agriculture will give a short course in beekeeping on February 8 to 19.

A short course in beekeeping was offered by the School of Agriculture, State College, Raleigh, N. C., on January 19, 20 and 21.

An interesting bulletin has recently appeared, entitled "Pollination and the Honey Bee" by Mr. Harry F. Dietz, of the Indiana State Division of Entomology.

The University of Manitoba offered its fourth annual short course in beekeeping in the Department of Entomology, Manitoba Agricultural College, Winnipeg, Manitoba, Canada, January 18 to 29.

Mr. Jas. I. Hambleton of the Bee Culture Laboratory of the Bureau of Entomology attended the meeting of the Illinois State Beekeepers' Association at Springfield on December 8.

According to *Gleanings in Bee Culture*, Mr. B. F. Kindig, president of the American Honey Producer's League, has resigned his position as State Apiary Inspector of Michigan, but has not announced his plans for the future.

The annual convention of the New Jersey Beekeepers' Association was held at Trenton, January 14 and 15. Mr. G. H. Cale of the American Bee Journal was announced as one of the speakers from outside the State.

Dr. A. P. Sturtevant of the Bee Culture Laboratory of the Bureau of Entomology spoke before the Ontario Beekeepers' Association at Toronto on December 2 and 3. Over 400 were in attendance at one of these meetings.

A radio talk on bees and honey is being broadcasted on the first Friday evening of each month at 8:10 o'clock, by Station WAAW, Omaha, Neb., the talks being given by F. M. Parsons, secretary of the Nebraska Beekeepers' Association.

Prof. F. B. Paddock announced a short course in beekeeping at the Iowa Agricultural College, Ames, Iowa, from January 4 to March 19. The annual meeting of the Iowa State Beekeepers' Association was held at Des Moines, December 3 and 4.

The annual meeting of the Pennsylvania State Beekeepers' Association was scheduled to be held in the Public Library, Harrisburg, Pa., January 20 and 21. Mr. W. J. Nolan of the Bee Culture Division of the Bureau of Entomology, Washington, D. C., was announced as one of the outside speakers.

Two short courses in beekeeping were arranged for January in California: one at Chico, January 22 and 23, and the other at Santa Ana, January 26 and 27. Among the speakers from a distance were Jas. I. Hambleton and Kenneth Hawkins. Mr. G. H. Vansell, Davis, Calif., is secretary of the California State Beekeepers' Association.

That a colony of bees will survive a three weeks' journey through the tropics in good condition, if kept at the proper temperature, is proven by the arrival in New Zealand of a colony shipped from British Columbia. The trip was made on a boat carrying a load of apples kept at a constant temperature of 40°F.

The annual meeting of the Ohio Beekeepers' Association has been announced for February 4 and 5, at the Ohio State University, Columbus, O. Some of the speakers announced are: Dr. E. F. Phillips, Cornell University, Ithaca, N. Y.; Dr. A. P. Sturtevant of the Bee Culture Laboratory, Washington, D. C.; E. R. Root, Medina, O.; Dr. Ernest Kohn, Chas. N. Poling, C. A. Reese, F. B. Moore and Dr. J. C. Hutzelman. Miss Florence Naile is secretary of the Association.

Since the last issue of this JOURNAL, announcement has been made of the death of Prof. N. B. Kunnen of Luxemburg. He had been a beekeeper for 60 years, and a teacher of beekeeping for 50 years, being at the time of his death Honorary Professor of Apiculture at Ettelbruck, Luxemburg. He was also a vice-president of the

International Apicultural Congress, while only last year the French government recognized his services by granting him the title of Chevalier de Mérite Agricole.

Prof. Dr. Y. Tokuda, in charge of bee-culture at the Imperial Zoo-technical Experiment Station at Chiba, Japan, was a recent visitor at the Bee Culture Laboratory. Dr. Tokuda is known for his work on the native Japanese honeybee, a species of *Apis indica*, and also for his work on poisonous honeys of Japan. He came to the United States from Europe where he had visited apicultural leaders in various countries. Other recent visitors at the Bee Culture Laboratory included Dr. S. Soudek, in charge of beekeeping at the Zoological Institute of the College of Agriculture and Forestry, Bruno, Czechoslovakia; Mr. E. R. Root, President of the A. I. Root Co.; Mr. R. B. Willson, Extension Specialist in Apiculture for New York State; and Mr. Geo. H. Rea, Extension Apiarist in Pennsylvania.

Mr. E. L. Sechrist of the Bee Culture Laboratory of the Bureau of Entomology, recently returned from a two months' trip devoted to visiting the principal western comb-honey centers. His mission was to obtain first-hand data on which to base comb-honey grading rules which will be applicable in every region of the country. An investigation was made of comb-honey in warehouses of both producers and dealers. Mr. Sechrist's itinerary included Chicago, Milwaukee, Denver, Ogden, Salt Lake City, Sacramento, San Diego, Los Angeles, San Francisco, and points in Wyoming and Montana. On December 18, he visited comb-honey dealers in New York City to ascertain their ideas and needs on grading. Among the establishments visited was the Herchel Jones Marketing Service. Mr. R. B. Willson, Extension Specialist in Apiculture for New York, was present to go over the situation with Mr. Sechrist.

Notes on Medical Entomology

According to *Science*, Dr. L. O. Howard has been elected honorary chairman of the National Malaria Committee to succeed the late Dr. Henry Rose Carter.

A conference between Federal and State officers concerning the mosquito situation along the Gulf Coast of Louisiana and Mississippi was held in New Orleans, La., on October 15, 1925. Dr. L. O. Howard and Dr. W. V. King represented the Bureau of Entomology.

According to *Science*, the U. S. Public Health Service will make an extensive survey of malaria in Polk, Hillsborough and Citrus Counties, Florida. Headquarters of the investigation will be at Lakeland under the direction of Bruce Mayne, Assistant Technical Engineer, who investigated the malaria situation in this community in 1917. The present survey will require several months.

According to *Science*, the League of Nations Health Committee has decided to create a "Lothian Scholarship" and a "Darling Prize" in memory of Doctors Norman Lothian (British) and Samuel T. Darling (American), two members of the Malaria Commission of the League who were killed in an automobile accident near Beirut last May while investigating malaria conditions in Syria. These will be awarded periodically for the encouragement of malariological study.

Probably the largest single publication, and in many respects the most important mosquito publication of the year is T. W. Kirkpatrick's "The Mosquitoes of Egypt," prepared under the Antimalaria Commission and published by the Government

Press at Cairo. It is a royal octavo paper covering some 225 pages, and is abundantly illustrated by plates and maps. Mr. Kirkpatrick handles his subject from the systematic point of view, and gives also a rather full account of the ecology and biology of mosquitoes in general, and elaborates the distribution, seasonal prevalence, ecology and biology of the species occurring in Egypt.

Many interesting points are considered with care, especially the salinity of the water of the breeding places, the association of the larvae of the different species, the geographical grouping of the species.

We have nowhere in the United States conditions that at all closely approximate those prevalent within the geographical boundaries of Egypt, but there are many points which may be compared in an interesting practical way with those that exist in Algeria as developed by the painstaking work of the Sergent brothers. A reading of the book emphasizes in one's mind the fact that the Culicidae form an extraordinarily variable group capable of the most remarkable adaptations.

Notes on Horticultural Inspection

Mr. A. K. Gibson was transferred from gipsy moth scouting in Quebec to plant inspection work at Niagara Falls, Ont., on November 21.

The State of Illinois has recently placed an embargo on Canadian seed corn owing to the presence of the European corn borer in Ontario.

Mr. L. B. Smith recently addressed the Plant Quarantine Conference of the northeastern and central Atlantic States on the subject of the Japanese beetle situation, with particular reference to the quarantine work.

Dr. Norman Perrine of the Federal Horticultural Board left recently for a trip to some of the Mexican Border ports to check up on cotton fumigation work in progress at these ports.

Mr. Lee A. Strong, Assistant Director of Agriculture of the State of California, was elected chairman of the Section of Plant Quarantine and Inspection at the recent meeting in Kansas City.

Gipsy moth scouting work in the Barrier Zone strip was greatly retarded during the month of November, as it was necessary to transfer a large number of men for Christmas tree inspection.

In view of the discovery of the pine shoot moth in certain Ontario nurseries, arrangements are being made to reinspect all pines imported into Canada since the new regulations came into force in 1923.

Mr. Edward Malloch of the Canadian Entomological Branch was recently assigned to gipsy moth quarantine work in southern Quebec where he was held responsible for all shipments of Christmas trees from the restricted area.

The Quebec provincial crews engaged in gipsy moth scouting were withdrawn from the field on October 31. This has necessitated a rearrangement of the federal scouting crews in order to take over the extra work.

A living specimen of the pink bollworm, *Pectinophora gossypiella* Saund., was recently taken at the Inspection House of the Federal Horticultural Board in Washington, in a small shipment of cotton seed from the Agricultural Experiment Station at Tokio, Japan.

Mr. L. M. Scott, Associate Chief, Plant Quarantine Inspection Service, of the Federal Horticultural Board, is visiting a number of the southern ports including Galveston, New Orleans, Mobile, Savannah and Charleston. He will return to Washington about the last of January.

Mr. J. T. Rogers, who is in charge of the work of the Federal Horticultural Board at Charleston, S. C., recently completed an inspection of the plants ready for distribution from the Plant Introduction Field Stations of the Department of Agriculture located at Savannah, Ga., and Coconut Grove, Fla.

Messrs. Arthur Finnamore, W. St. G. Ryan, R. W. Sheppard, W. A. Fowler and C. S. Thompson, District Inspectors at the various eastern Canadian ports of entry, visited Ottawa November 26–December 5, to attend a conference with Mr. McLaine and other officers at headquarters relative to problems arising in plant inspection work. While in Ottawa they also attended the meetings of the Entomological Society of Ontario and took part in the conference of officers in charge of eastern laboratories, special projects and inspection ports.

A new quarantine on account of flag smut of wheat, effective February 1, 1926, has just been announced by the Department of Agriculture. The new Quarantine, No. 59, will supersede Quarantine No. 39, which has been in effect since August 15, 1919. It will prohibit the importation into the United States from India, Japan, China, Australia, Union of South Africa, Italy and Spain, of all species and varieties of wheat and wheat products, except such as have been so milled or processed as to have destroyed all flag smut spores. The changes brought about by the new quarantine will remove the restrictions on wheat importations which are now in effect on account of the take-all disease of wheat. Under the new ruling, oats, barley, and rye will not be barred as formerly from France, Germany, Belgium, India, Japan, Australia and Italy.

ENTOMOLOGICAL SOCIETY OF PENNSYLVANIA

The Third Annual Meeting was held at the offices of the Bureau of Plant Industry, Harrisburg, January 18, 1926. This meeting was called in conjunction with a conference of the Oriental fruit moth workers of Pennsylvania and adjoining states. The following members were present: C. H. Hadley, T. L. Guyton, J. L. Stear, F. H. Worsinger, Jr., F. F. Smith, G. B. Stichter, F. M. Trimble, A. B. Champlain, F. L. Holdridge, H. B. Kirk, J. N. Knull, of the Pennsylvania Bureau of Plant Industry; H. E. Hodgkiss, G. F. McLeod, G. H. Rhea, H. N. Worthley, E. H. Dusham, and S. W. Frost of the Pennsylvania State College; H. D. Smith, and C. C. Hill of the Federal Bureau of Entomology, and Eugene Craighead, P. T. Barnes, and C. F. G. Carpenter representing commercial insecticide companies. The afternoon was devoted to discussions of the biology and control of the Oriental fruit moth. Seven guests were present whose interests were chiefly in the Oriental fruit moth, namely: Dr. Alvah Peterson, Mr. Hacussler, and Mr. J. A. Hyslop of the Federal Bureau of Entomology; Dr. P. Garman of Connecticut; L. A. Stearns of New Brunswick, N. J., and Prof. E. N. Cory and Mr. McConnell of College Park, Md. Following the afternoon session, the Society adjourned for supper to the University Club. The program was continued after supper. Mr. J. A. Hyslop explained the Insect Pest Survey and the value of Statistical data on insects. Prof. E. N. Cory discussed the status of the potato tuber moth in Maryland. Mr. C. C. Hill spoke of the abundance of the Hessian fly in Pennsylvania and adjoining states during the past years. Following the program a short business session was called and C. H. Hadley and S.W. Frost were re-elected president and secretary respectively.